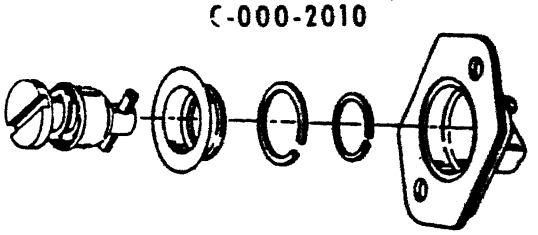
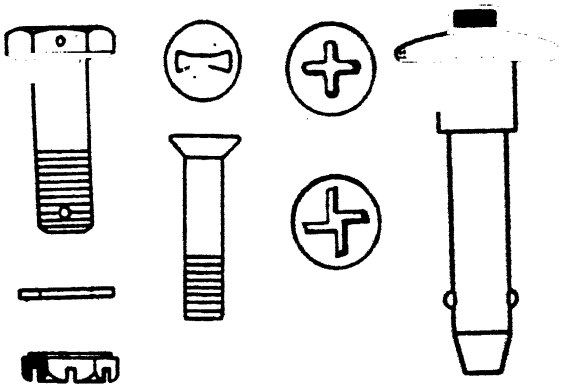
INDIVIDUALIZED INSTRUCTION

AVIATION FUNDAMENTALS COURSE

C-000-2010





MODULE ONE

LESSON TOPIC 1-10

AIRCRAFT HARDWARE

CNTT-M1357 (Rev 8-82)

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LESSON TOPIC OVERVIEW

LESSON TOPIC 1.10

AIRCRAFT HARDWARE

In this lesson topic, you will study a variety of fastening devices and procedures, so that you will be able to identify, select, and use the proper fasteners for your specific job. All fasteners are designed for one purpose: to attach components together securely.

TERMINAL OBJECTIVE

Match four given illustrations of different types of aircraft hardware with their uses.

ENABLING OBJECTIVES

1. Select, from a given list, the use of the common solid shank rivet.
2. Select, from a given list, the use of the blind rivet.
3. Match four given illustrations of types of screws commonly used on aircraft with their names.
4. Match four given illustrations of types of structural screwheads commonly used on aircraft with their names.
5. Match three listed types of standard aircraft bolts with their purposes.
6. Match four given illustrations of bolthead markings with statements describing their meanings.
7. Match four given bolt-dimension terms with the bolt sections they describe, as designated on a given illustration.
8. Match four given illustrations of types of nuts used in aircraft structures with their functions.

9. Match three given illustrations of types of washers used in aircraft structures with their uses.

10. Match four given illustrations of types of pins used in aircraft structures with their uses.

11. Select, from a given list, the use(s) of threaded inserts in the design of aircraft, engines, and accessories.

12. Select, from a given list, the use(s) of turnlock fasteners.

13. Select, from a given list, the reason(s) for using bonding wire on aircraft.

14. Select, from a given list, the precaution(s) to observe to prevent foreign object damage.

NOTE: Review the list of study resources prior to studying the lesson topic.

LIST OF STUDY RESOURCES

LESSON TOPIC 1.10

AIRCRAFT HARDWARE

To learn the material in this lesson topic, you may choose any, or all, of the following study resources:

WRITTEN LESSON TOPIC PRESENTATIONS IN MODULE BOOKLET:

Any of the resources listed above may be used in achieving the learning objectives. It is not necessary to use them all. The progress check, which may be taken at any time, is your means of determining when you are ready to proceed to the next lesson topic. If you fail to meet any objective, you must either review the material or study another medium of instruction. Your learning center instructor will assist you if there is anything you do not understand.

LESSON TOPIC SUMMARY

AIRCRAFT HARDWARE

Rivets are used extensively in aircraft structures as fastening devices. The common solid shank rivet is used in fastening together an aircraft structure where both ends of the rivet are accessible. The blind rivet is used where only one side of the work is accessible. (See figure 10-1.

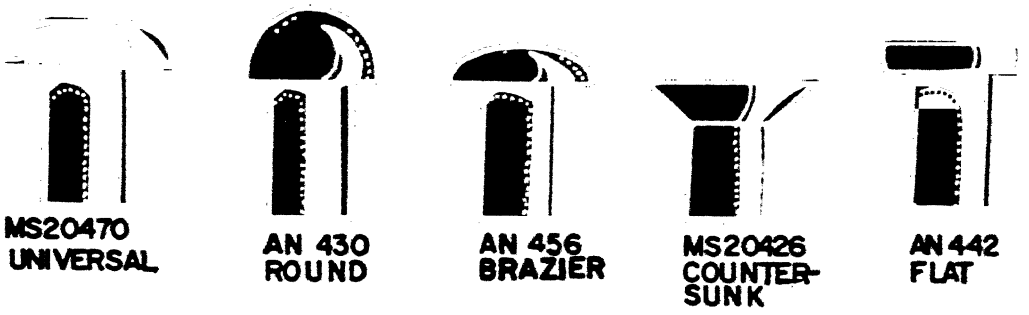


FIGURE 10-1.--Common solid shank rivets.

Screws are the commonest type of threaded fastener used on an aircraft. They may be divided into four main groups--machine screws, self-tapping screws, setscrews, and structural screws. The machine screw is different from the structural screw only in the materials used and their relative material strengths.

Structural or machine screws have a number of different head styles--brazier, washer, fillister, and flat (see figure 10-2).

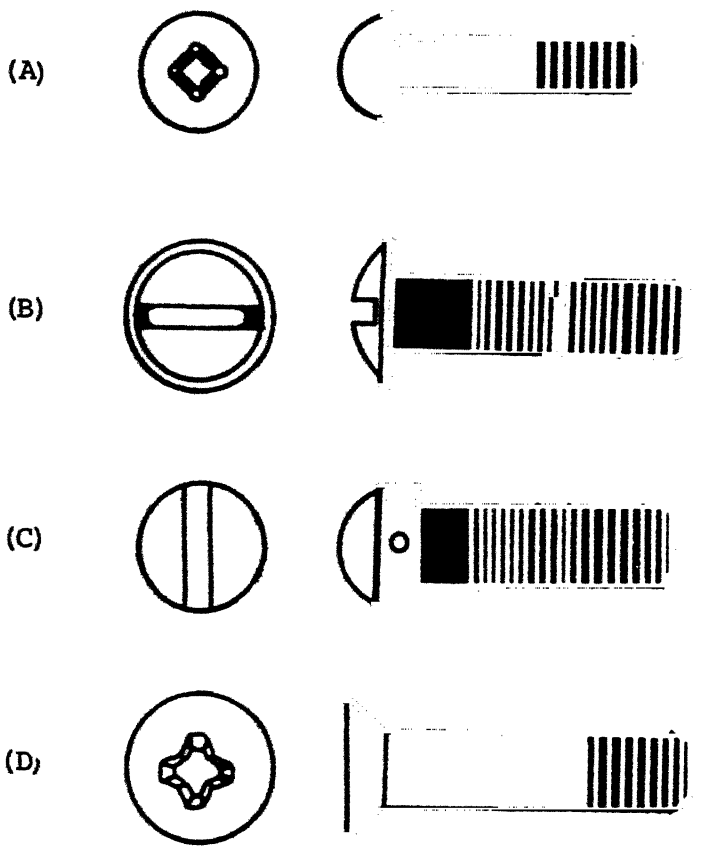
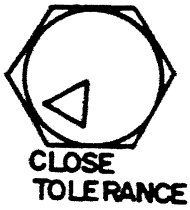


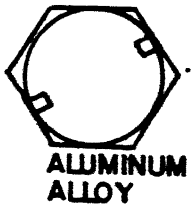
FIGURE 10-2.--Structural or machine screws: (A) brazier; (B) washer; (C) fillister; and (D) flat.

Standard aircraft bolts are used in applications involving tension shear loads. The close-tolerance bolt is used where the bolted joint is subject to severe load reversals and vibrations. The clevis bolt, which is used in applications subject to shear stress only, is often used as a mechanical pin in a control system. The eyebolt is used to carry external tension loads for the attachment of such devices as the fork of a turnbuckle, a clevis, or a cable shackle.

The mark or marks on the head of a bolt or screw identify the material of which it is made. (See figure 10-3.)

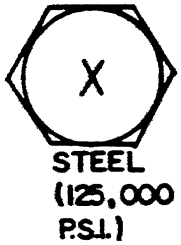


A recessed triangle denotes close-tolerance shank and/or head (steel or aluminum alloy).



Two raised dashes denote aluminum alloy.

A single raised dash denotes corrosion-resistant steel.



A cross denotes alloy steel with a tensile strength of 125,000 psi minimum.

A curved section with five crosses denotes steel with a tensile strength of 160,000 to 180,000.

FIGURE 10-3.—Bolthead markings.

The most significant terms in describing a bolt or a screw are the head, the grip, threads, length, and diameter (see figure 10-4).

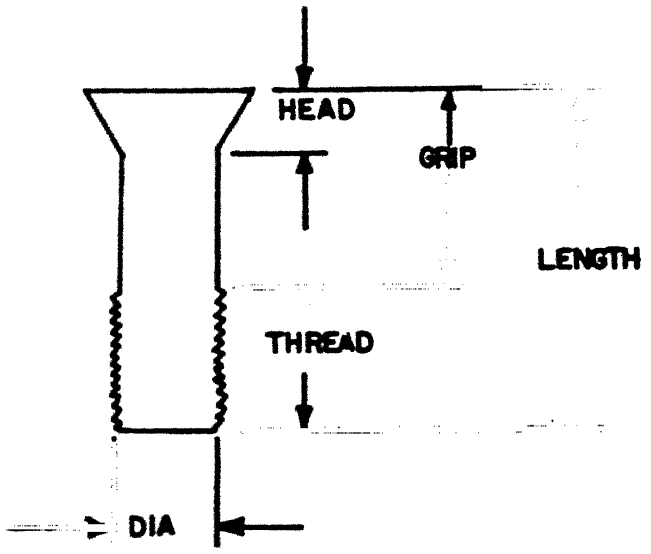


FIGURE 10-4.--Principal parts of a bolt or a screw.

Nuts used in aircraft structures are plain, castle, wing, and self-locking nuts. (See figure 10-5.)

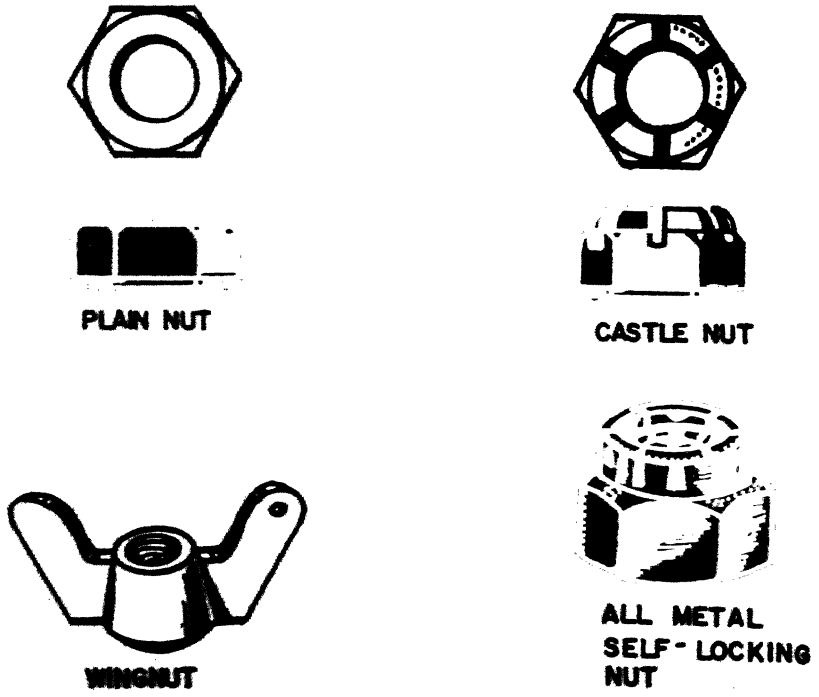


FIGURE 10-5.--Nuts used in aircraft structures.

The plain nut is used with an auxiliary locking device, such as a lockwasher. The castle nut is used with a drilled shank bolt and is secured with lockwire or a cotter pin. The wingnut is used where the desired tightness can be obtained with the fingers and where the assembly is frequently removed. The self-locking nut is designed so that it will hold tight in spite of vibrations.

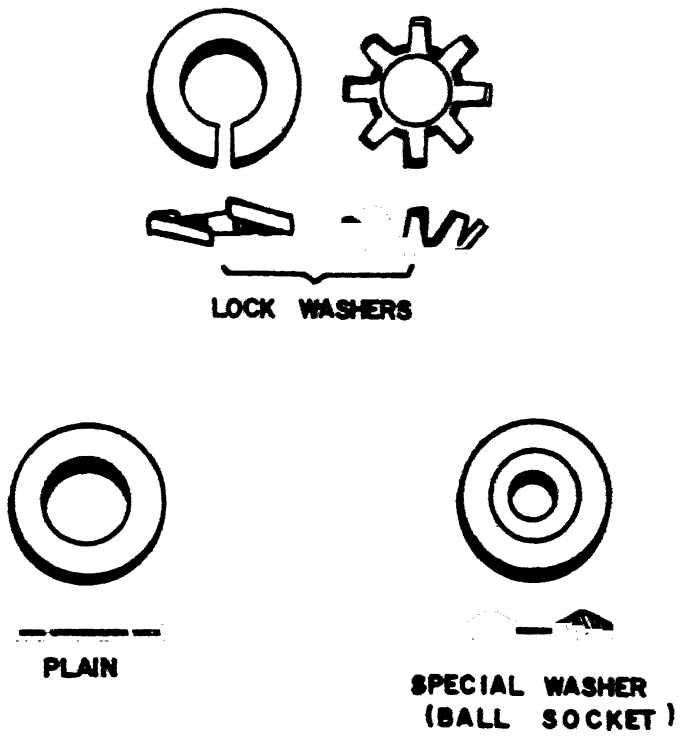


FIGURE 10-6.--Washers used in aircraft structures.

The types of washers used in aircraft structures are plain washers, lockwashers, and special washers (figure 10-6). The plain washer is used under a nut to provide a smooth bearing surface and to act as a shim. The lockwasher is used with a plain nut when a self-locking or castellated nut is not applicable. Many types and varieties of special washers are used in applications when directed by the maintenance instructions manual.

Pins used in aircraft structures are taper pins, flathead pins, cotter pins, and quick-release pins (figure 10-7).

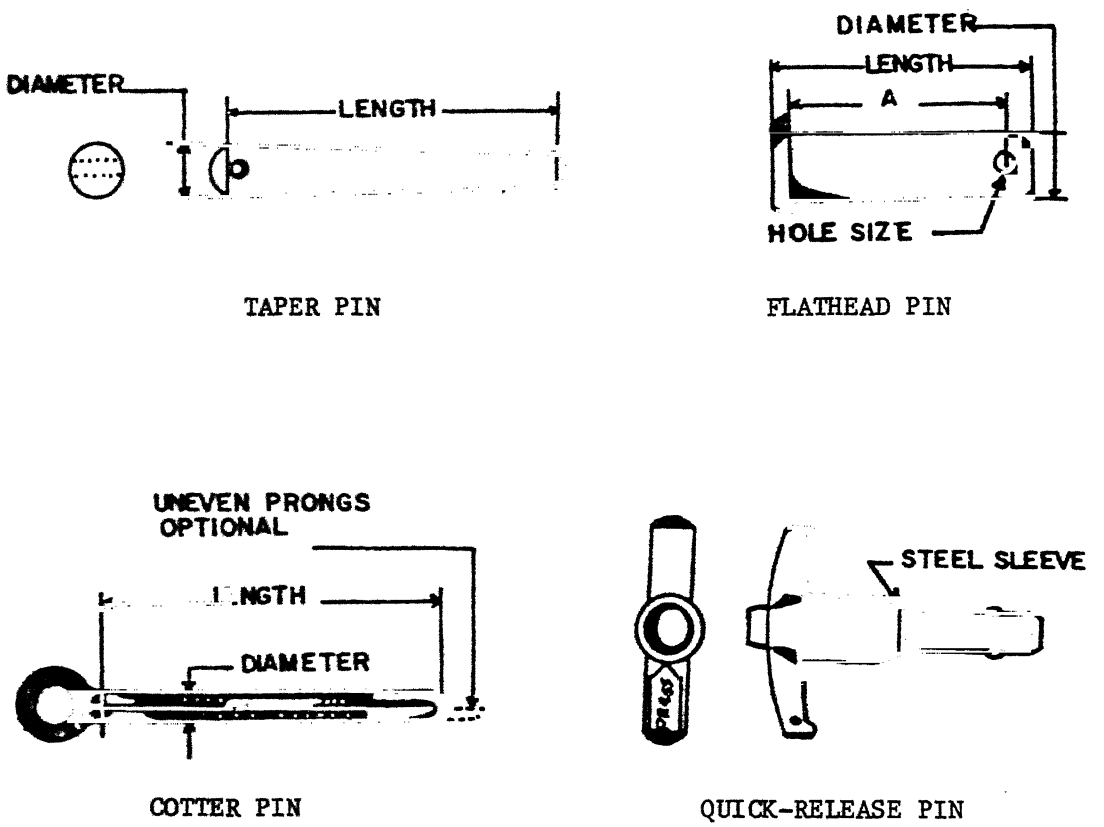


FIGURE 10-7.--Pins.

The taper pin has no head and is used where a tight fit is essential. The flathead pin is used with a tie rod terminal or a secondary control that is not in operation continuously. The cotter pin is used to secure castellated nuts, pins, and shafts. The quick-release pin is used in some applications where rapid removal and replacement of equipment are necessary.

Threaded inserts are commonly used in the design of aircraft, engines, and accessories to protect and strengthen tapped threads in light materials (for example, aluminum, brass, and plastic), particularly in locations requiring frequent assembly and disassembly.

Turnlock fasteners are used to secure cowling, fairing, panels, and doors that require quick or frequent removal and replacement.

Bonding wire is used to connect all equipment so that static electricity is eliminated. An aircraft can become highly charged with static electricity while in flight. This constitutes a fire hazard and also causes radio and navigation equipment interference.

Aircraft structural hardware is the greatest contributor to foreign object damage (FOD). The removal of loose objects from pockets before working on an aircraft, the cleaning of work areas upon completion of a job, and a complete inventory of toolboxes are musts in preventing FOD.

At this point, you may take the progress check beginning on page 77. If you answer all self-test items correctly, proceed to the next lesson topic. If any of your answers are incorrect, refer to the paragraphs or frames designated on the answer sheet for the items you missed. If you feel that you do not understand most of the lesson topic, select another medium of instruction or consult your learning center instructor. When you can correctly answer all self-test items on the progress check, proceed to the next assignment.

PROGRAMMED INSTRUCTION FORM

OF

LESSON TOPIC

AIRCRAFT HARDWARE

1. Besides the metal surfaces, which are readily seen, many different kinds of hardware are used in assembling an aircraft--rivets, screws, bolts, nuts, washers, pins, bonding wire, turnlocks, fasteners, etc. Rivets are used extensively as fastening devices. The common solid shank rivet, shown in figure 10-1, is used in fastening together an aircraft structure when both ends of the rivet are accessible. Its head may be one of several styles. Of these, the universal head rivet is used for both interior and exterior applications, and the countersunk head rivet is used on the exterior of an aircraft where a smooth aerodynamic surface is desired.

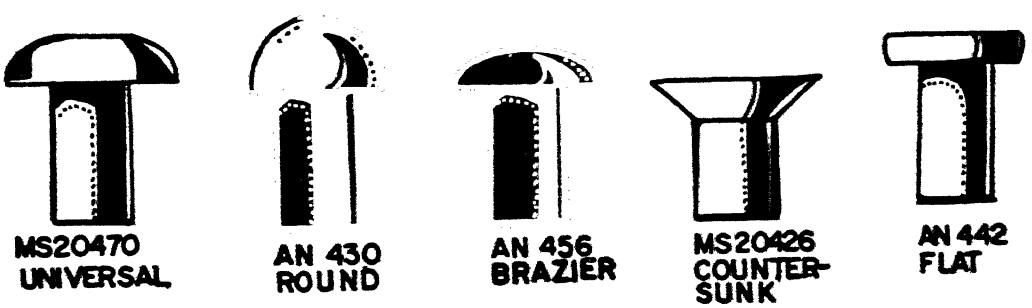


FIGURE 10-1.--Common solid shank rivets.

1. (Continued)

The blind rivet is used where only one side of the work is accessible. There are various types and head styles of blind rivets (figure 10-2), and all have the characteristic of being self-locking.

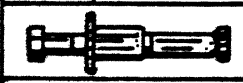
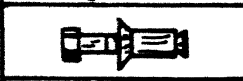
TYPE	CONFIGURATION	HEAD IDENTIFICATION	BASIC NO.
SELF PLUGGING		100 DEGREE COUNTERSUNK	MS20601
		UNIVERSAL HEAD	MS20600
		LARGE FLAT HEAD	CR198C
HOLLOW PULL THRU		100 DEGREE COUNTERSUNK	MS20605
		LARGE FLAT HEAD	CR148

FIGURE 10-2.—Blind rivets.

When an aircraft must be repaired, rivets (as well as all other fasteners) should be replaced with an identical piece of hardware. Otherwise, the structural soundness of the aircraft will deteriorate. Even the resistance to corrosion will change if unlike metals are joined.

a. If both ends of the rivet are accessible, the aircraft structure is joined with the _____ _____ rivet.

b. When only one side of the work is accessible, the _____ rivet is used.

a. solid shank b. blind	2. Select, from the list below, the use of the common solid shank rivet. a. Used when only one side of the work is accessible. b. Used to secure panels on the aircraft exterior only. c. Used for fastening aircraft structures when both ends of the rivet are accessible. d. Used to secure panels on the aircraft interior only.
c.	3. Select, from the list below, the use of the blind rivet. a. To be used when only one side of the work is accessible. b. To be used to secure panels when both sides of the work are accessible. c. To be used only when a smooth aerodynamic design is required. d. To be used as a temporary repair only.
a.	4. The screw is the commonest type of threaded fastener used on an aircraft. Generally, screws have a lower material strength and a looser fit than other types of threaded fasteners; however, several types of structural screws are available that differ from structural bolts only in the type of head. Screws may be divided into four main groups—the machine screw, the structural screw, the self-tapping screw, and the setscrew. (See figure 10-3.) Each

(Continued)

requires a particular type of screwdriver for installation. The machine screw is different from the structural screw only in the materials used and their relative strengths.

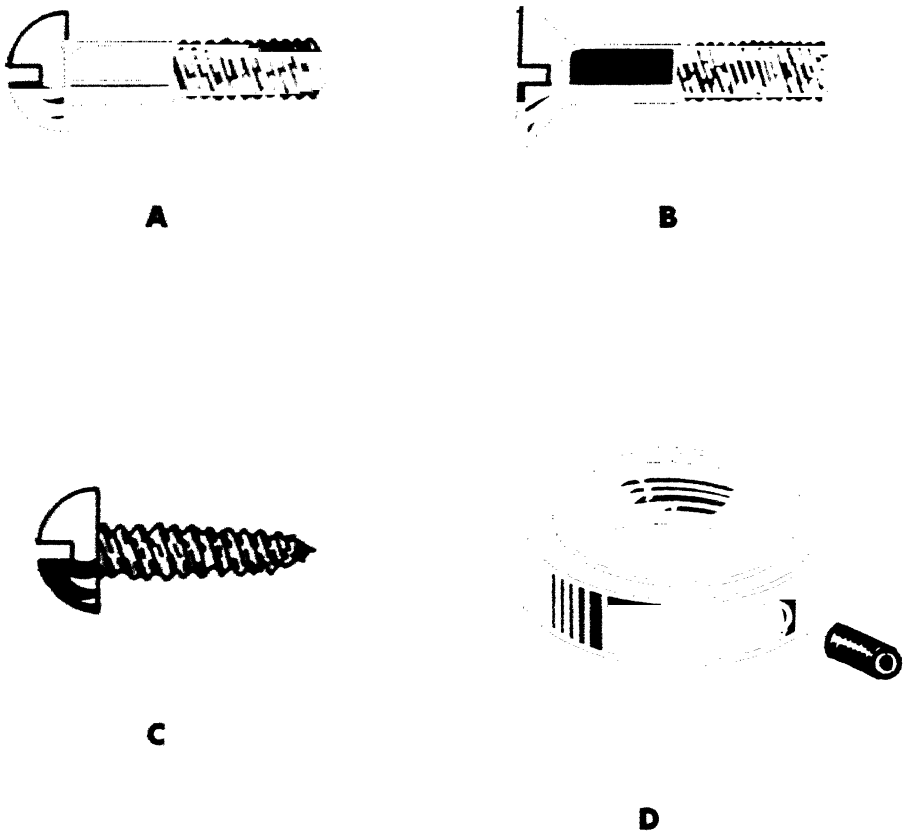


FIGURE 10-3.—Screws: (A and B) machine or structural; (C) self-tapping; and (D) setscrew.

4. (Continued)

The machine screw (A or B) is a small general purpose screw (available in low-carbon steel, brass, corrosion-resistant steel, and aluminum alloy) with various head styles. The heads of some machine screws are drilled for safety wire.

The structural screw (A or B) is used primarily for panel installation where frequent removal is required. This screw is made of alloy steel and is heat-treated to have the same tensile strength as a bolt of the equivalent size. Note that the structural screw and the machine screw may have the same shape, the difference being in the materials and their tensile strengths.

The self-tapping screw (C) is used in nonstructural assemblies requiring a blind application. The screw is installed by drilling a hole and inserting the screw, which cuts its own thread as it is screwed into the hole.

The setscrew (D) is used to position and hold a component in place; for example, a gear or bearing on a shaft. Setscrews, which are headless, are available with many different point styles.

The four types of screws used on aircraft are _____, _____, _____, and _____.

structural

machine

self-tapping

setscrew

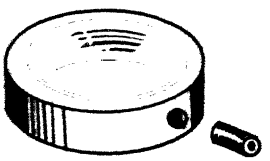
5. Match each of the screws illustrated in column *A* with its name in column *B*.

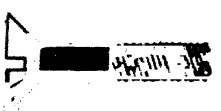
A

B

____(1) 

____(2) 

____(3) 

____(4) 

a. Setscrew.

b. Structural or machine screw.

c. Self-tapping screw.

d. Self-set screw.

(1) c.

(2) b.

(3) a.

(4) b.

6. Select, from the list below, the use of the blind rivet.

a. To be used to secure panels when both sides of the work are accessible.

b. To be used only when a smooth aerodynamic design is required.

c. To be used when only one side of the work is accessible.

d. To be used as a temporary repair only.

c.

7. Select, from the list below, the use of the common solid shank rivet.

a. Used to secure panels on the aircraft exterior only.

b. Used for fastening aircraft structures when both ends of the rivet are accessible.

c. Used when only one side of the work is accessible.

d. Used to secure panels on the aircraft interior only.

b. 8. Machine screws and structural screws have a number of different head styles--brazier, washer, fillister, and flat (see figure 10-4.)

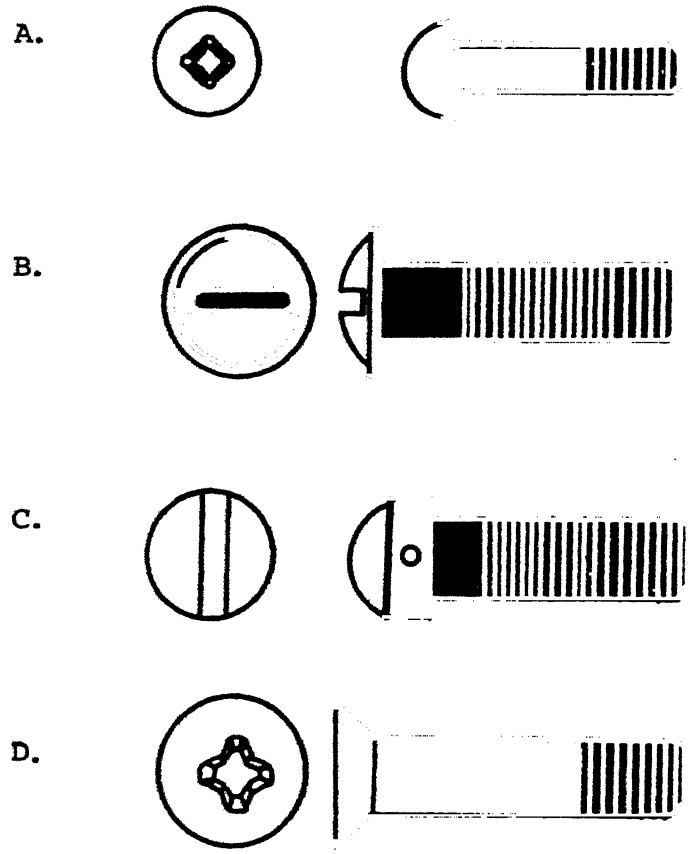


FIGURE 10-4.--Structural or machine screws: (A) brazier; (B) washer; (C) fillister; and (D) flathead.

The brazier head, the washer head, and the fillister head are normally used in the interior of the aircraft. The flathead screw is primarily used on the exterior of the aircraft and requires a hole that has been countersunk for a smooth surface.

8. (Continued)

a. The brazier head, washer head, and fillister head screws are used in the _____ of the aircraft.

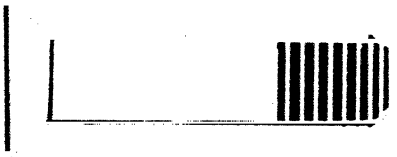
b. The flathead screw is used on the _____ of the aircraft.

a. interior b. exterior

9. Match each of the four types of structural (machine) screwheads illustrated in column *A* with its name in column *B*.

A

___ (1)



___ (2)

___ (3)

___ (4)

B

a. Fillister head.

b. Flathead.

c. Washer head.

d. Brazier head.

e. Filbert head.

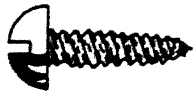
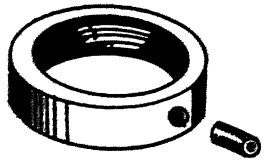
(1) b.

(2) d.

(3) c.

(4) a.

10. Match each of the screws illustrated in column *A* with its name in column *B*.

A		B
____ (1)		a. Self-tapping screw.
____ (2)		b. Self-set screw.
____ (3)		c. Structural or machine screw.
____ (4)		d. Setscrew.

(1) a.

(2) c.

(3) d.

(4) c.

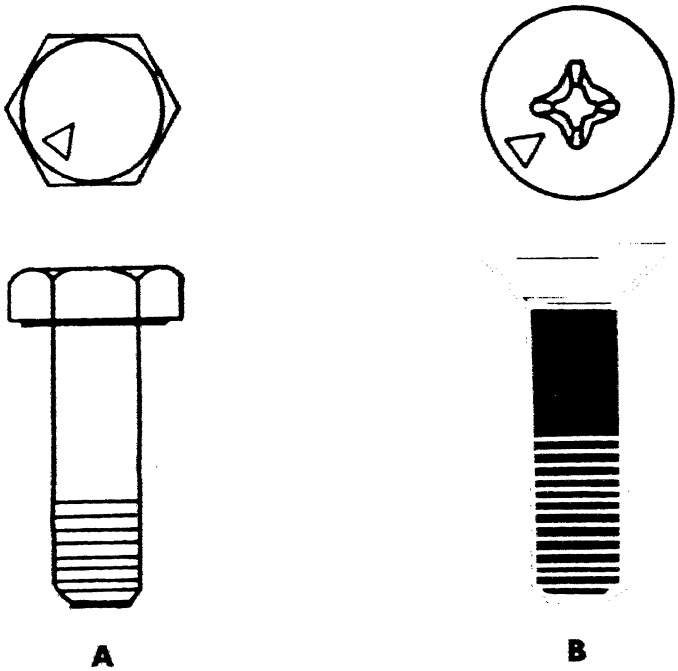
11. Select, from the list below, the use of the blind rivet.

a. To be used to secure panels when both sides of the work are accessible.

b. To be used only when a smooth aerodynamic design is required.

c. To be used as a temporary repair only.

d. To be used when only one side of the work is accessible.

d.	12. Select, from the list below, the use of the common solid shank rivet. a. Used to secure panels on the aircraft exterior only. b. Used for fastening aircraft structures when both ends of the rivet are accessible. c. Used to secure panels on the aircraft interior only. d. Used when only one side of the work is accessible.
b.	13. Standard aircraft bolts are used in applications involving tension shear loads. The close-tolerance bolt is used where the bolted joint is subject to severe load reversals and vibrations. The use of a close-tolerance bolt permits the elimination of lost motion in landing gears, control systems, and helicopter rotary controls.  FIGURE 10-5.—Close-tolerance bolts.

13. (Continued)

Close-tolerance bolts are available with two types of heads--the standard hex head (figure 10-5A) and the 100-degree countersunk head (figure 10-5B).

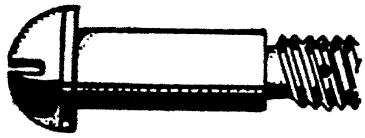


FIGURE 10-6.--The clevis bolt.

The clevis bolt (figure 10-6), which is used in applications subject to shear stress only, is often used as a mechanical pin in a control system. The head of the clevis bolt is round and slotted.

The eyebolt (figure 10-7) is used to carry external tension loads for the attachment of such devices as the fork of a turnbuckle, a clevis, or a cable shackle.

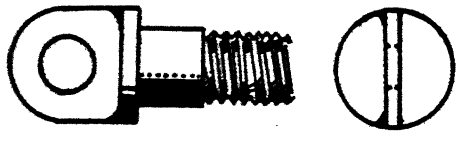


FIGURE 10-7.--The eyebolt.

13. (Continued)

a. For elimination of lost motion, the _____ _____ bolt is used.

b. The bolt that is often used as a mechanical pin in a control system is the _____ bolt.

c. The bolt used to attach such devices as the fork of a turnbuckle is the _____.

a. close tolerance

b. clevis

c. eyebolt

14. Match each of the standard aircraft bolts in column *A* with its purpose in column *B*.

A	B
____ (1) Clevis bolt.	a. Used as a mechanical pin in a control system.
____ (2) Eyebolt.	b. Used whenever the self-locking nut is used.
____ (3) Close-tolerance.	c. Used where a bolted joint is subject to severe load reversals and vibrations.
	d. Used in the attachment of such devices as the fork of a turnbuckle, a clevis, or a cable shackle.

15. Match each of the four types of structural (machine) screwheads illustrated in column *A* with its name in column *B*.

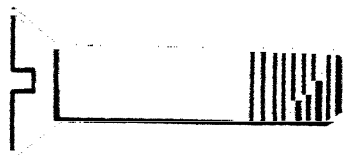
A

B

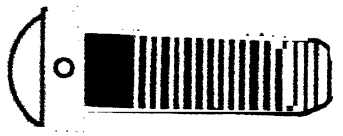
___ (1)

___ (2)

___ (3)



___ (4)



a. Washer head.

b. Brazier.

c. Fillister head.

d. Flathead.

e. Filbert head.

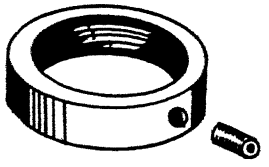
(1) a.

(2) b.

(3) d.

(4) c.

16. Match each of the screws illustrated in column A with its name in column B.

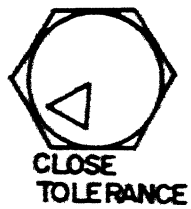
A		B
____ (1)		a. Self-set screw.
____ (2)		b. Self-tapping screw.
____ (3)		c. Setscrew.
____ (4)		d. Structural or machine screw.

(1) d. (2) d. (3) b. (4) c.

17. The mark or marks on the head of a bolt or screw identify the materials of which it is made. (See figure 10-8.)

A cross denotes alloy steel with a tensile strength of 125,000 psi minimum.

Two raised dashes denote aluminum alloy.



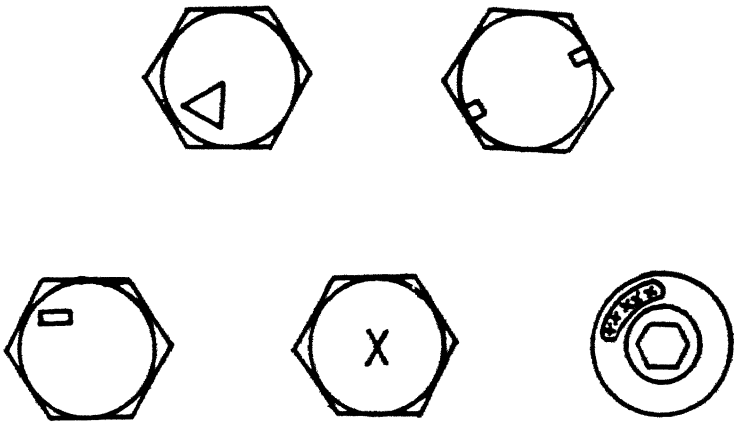
A recessed triangle denotes close-tolerance shank and/or head (steel or aluminum alloy).

A single raised dash denotes corrosion-resistant steel.

A curved section with five crosses denotes steel with a tensile strength of 160,000 to 180,000 psi.

FIGURE 10-8.--Bolthead markings.

17. (Continued)



Complete the following statements, identifying the bolthead markings above.

a. A close tolerance shank or head is denoted by a recessed _____.

b. Two raised dashes denote _____ alloy.

c. A bolt with a tensile strength of 125,000 psi minimum is marked with a _____.

d. Corrosion resistant steel is indicated by a single raised _____.

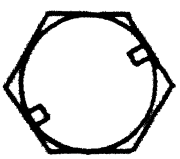
e. A steel bolt with a tensile strength of 160,000 to 180,000 psi is denoted with a

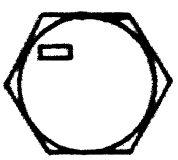
a. triangle
b. aluminum
c. cross
d. dash
e. curved section with five crosses

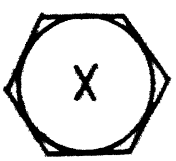
18. Match each bolthead marking illustrated in column *A* with the statement describing its meaning in column *B*.

A

___ (1) 

___ (2) 

___ (3) 

___ (4) 

___ (5) 

B

a. Aluminum alloy.
b. Steel (125,000 psi).
c. Corrosion resistant steel.
d. Close tolerance (steel or aluminum alloy).
e. Steel (160,000-180,000 psi).

(1) d. (2) a. (3) c. (4) b. (5) e.

19. Match each of the standard aircraft bolts, listed in column *A*, with its purpose, listed in column *B*.

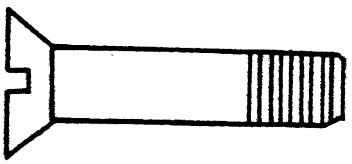
A	B
____ (1) Close-tolerance.	a. Used whenever the self-locking nut is used.
____ (2) Clevis bolt.	b. Used as a mechanical pin in a control system.
____ (3) Eyebolt.	c. Used in the attachment of such devices as the fork of a turnbuckle, a clevis, or a cable shackle.
	d. Used where a bolted joint is subject to severe load reversals and vibrations.

(1) d. (2) b. (3) c.

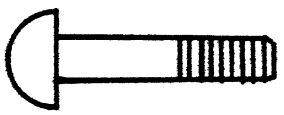
20. Match each of the four types of structural (machine) screwheads illustrated in column *A* with its name in column *B*.

A

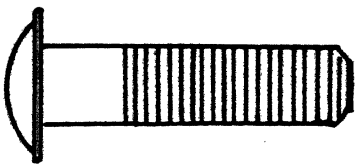
____ (1)



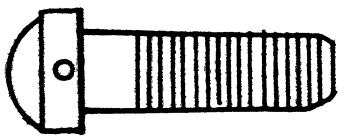
____ (2)



____ (3)



____ (4)



B

a. Washer head.

b. Fillister head.

c. Brazier head.

d. Flathead.

e. Filbert head.

(1) d.

(2) c.

(3) a.

(4) b.

21.

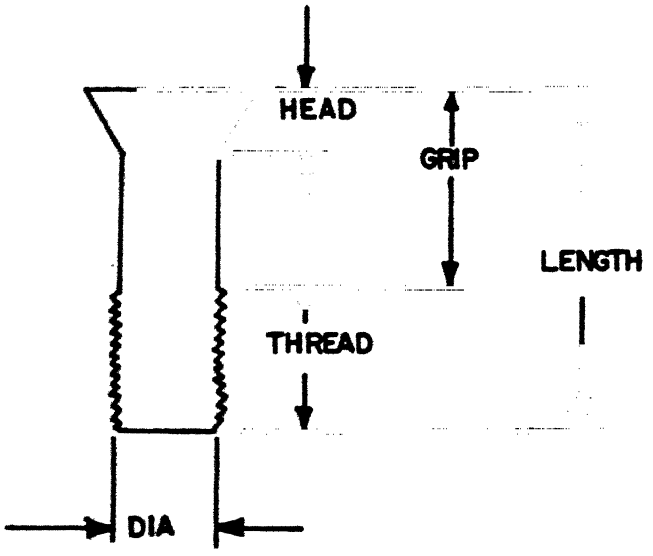


FIGURE 10-9.--Principal parts of a bolt or screw.

The most significant terms used in describing a bolt or a screw are the head, the grip, threads, length, and diameter (see figure 10-9). The head is that portion of the bolt or screw with the largest diameter and may be one of many shapes or designs. A wrench is normally placed on the bolthead for the purpose of installing or removing the bolt, whereas a screwdriver is used with a screw. The grip is the distance from the underhead bearing surface to the start of the thread. The ideal installation will have

21. (Continued)

a bolt or screw whose grip is a few thousandths of an inch shorter than the actual grip. All bolt or screw installations that involve self-locking or plain nuts will have at least two complete threads protruding through the nut. These two threads include the chamfered end of the bolt. However, bolts with slightly more grip length than that required may be used if washers are placed under the nut or bolthead.

The terms used in describing a bolt are the _____, the _____, the _____, the _____, and the _____.

head grip threads length diameter

22. Match each of the bolt-dimension terms listed in column *A* with the section it describes, as designated on the illustration in column *B*.

A

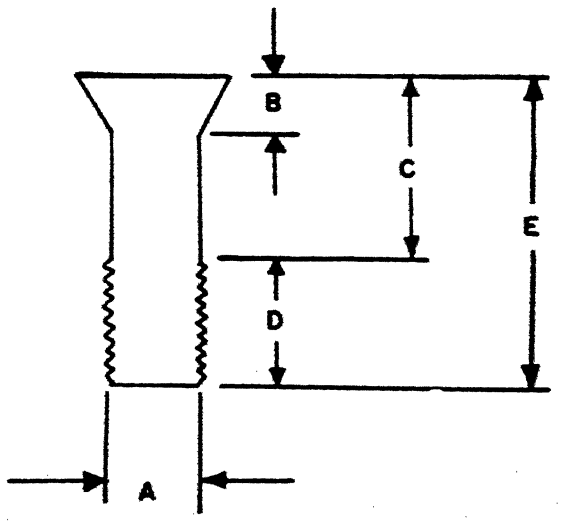
____ (1) Length.

____ (2) Diameter.

____ (3) Threads.

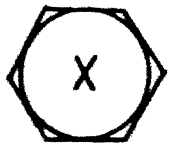
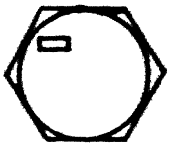
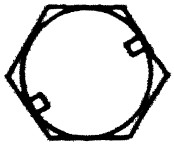
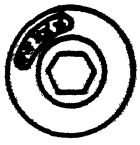
____ (4) Grip.

B



(1) E. (2) A. (3) D. (4) C.

23. Match each bolthead marking illustrated in column *A* with the statement describing its meaning in column *B*.

A		B
____ (1)		a. Close tolerance (steel or aluminum alloy).
____ (2)		b. Bronze.
____ (3)		c. Corrosion resistant steel.
____ (4)		d. Steel (125,000 psi).
____ (5)		e. Aluminum alloy.
		f. Steel (160,000-180,000 psi).

(1) d.

(2) c.

(3) a.

(4) e.

(5) f.

24. Match each of the standard aircraft bolts, listed in column *A* with its purpose, listed in column *B*.

A	B
____ (1) Eyebolt.	a. Used in the attachment of such devices as the fork of a turnbuckle, a clevis, or a cable shackle.
____ (2) Close-tolerance.	b. Used whenever the self-locking nut is used.
____ (3) Clevis bolt.	c. Used where a bolted joint is subject to severe load reversals and vibrations.
	d. Used as a mechanical pin in a control system.

(1) a.

(2) c.

(3) d.

25. The purpose of any nut is to secure the bolted assembly properly. Nuts used in aircraft structures are the plain nut, the castle nut, the wingnut, and the self-locking nut (figure 10-10).

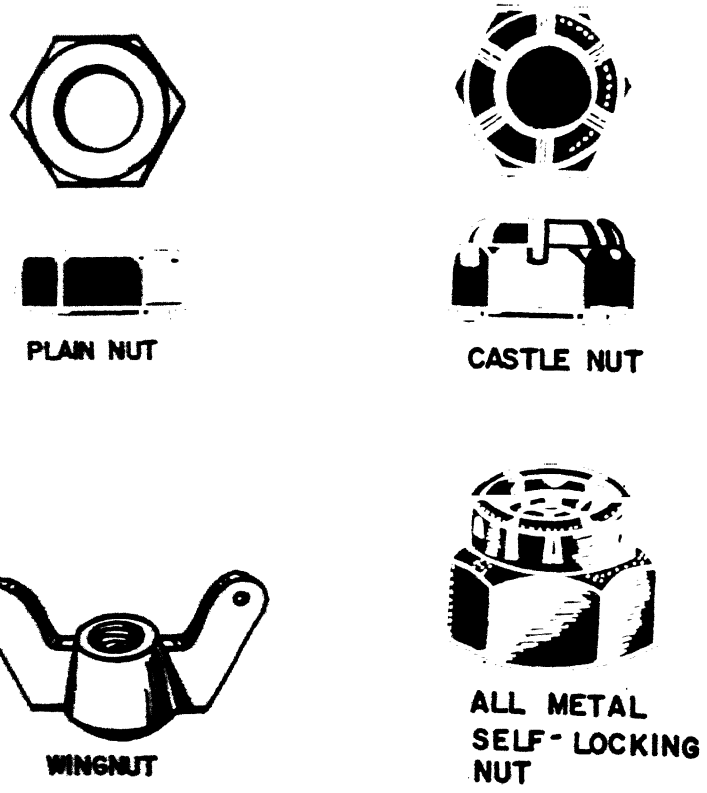


FIGURE 10-10.—Nuts used in aircraft structures.

25. (Continued)

The plain nut is used with an auxiliary locking device, such as a lockwasher. The castle nut is used with a drilled shank bolt and is secured with lockwire or a cotter pin. The wingnut is used where the desired tightness can be obtained with the fingers and where the assembly is frequently removed. The self-locking nut is designed so that it will hold tight in spite of vibrations.

a. A lock washer must be used with a _____ nut.

b. For safetying with a cotter pin or lockwire, a _____ nut must be used.

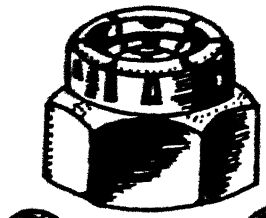
c. When the system is frequently removed and the desired tightness can be done with fingers, the _____ nut is used.

a. plain b. castle c. wing

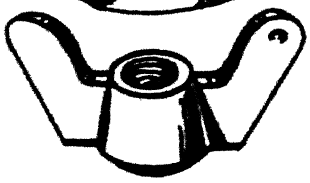
26. Match each nut illustrated in column *A* with its function in column *B*.

A

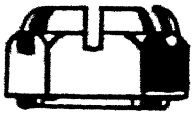
____ (1)



____ (2)



____ (3)



____ (4)

B

a. Used where desired tightness can be obtained by the fingers and where the assembly is frequently removed.

b. Designed to hold tight in spite of vibrations.

c. Used with an auxiliary locking device, such as a lockwasher.

d. Used with a drilled shank bolt to accommodate a cotter pin or safety wire for safetying.

e. Used with castellated bolt shank.

(1) b. (2) a. (3) d. (4) c.

27. Match each of the bolt-dimension terms listed in column *A* with the section it describes, as designated on the illustration in column *B*.

A

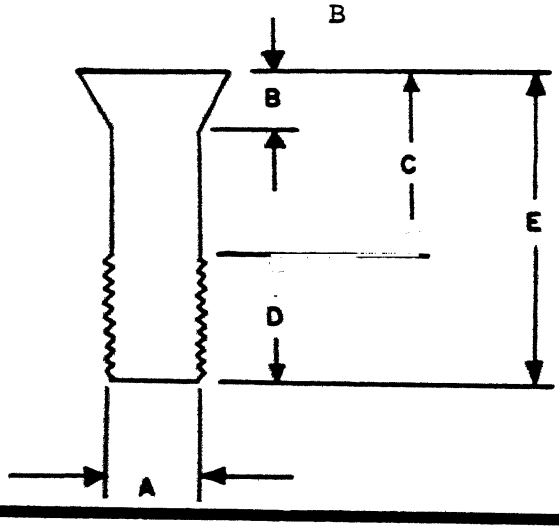
____ (1) Length.

____ (2) Diameter.

____ (3) Threads.

____ (4) Grip.

B



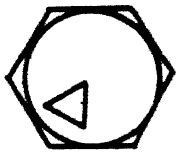
(1) E. (2) A. (3) D. (4) C.

28. Match each bolthead marking illustrated in column *A* with the statement describing its meaning in column *B*.

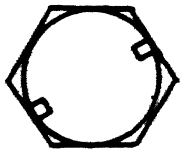
A

B

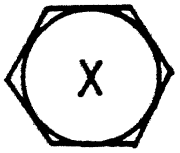
___ (1)



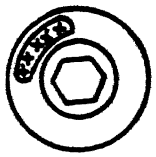
___ (2)



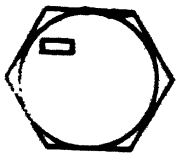
___ (3)



___ (4)



___ (5)



a. Steel (125,000 psi).

b. Aluminum alloy.

c. Steel (160,000 to 180,000 psi).

d. Corrosion resistant steel.

e. Close tolerance (steel or aluminum alloy).

f. Aluminum-nickel-cobalt alloy (ALNICO)

(1) e.

(2) b.

(3) a.

(4) c.

(5) d.

29. The types of washers used in aircraft structures are plain washers, lockwashers, and special washers (figure 10-11).

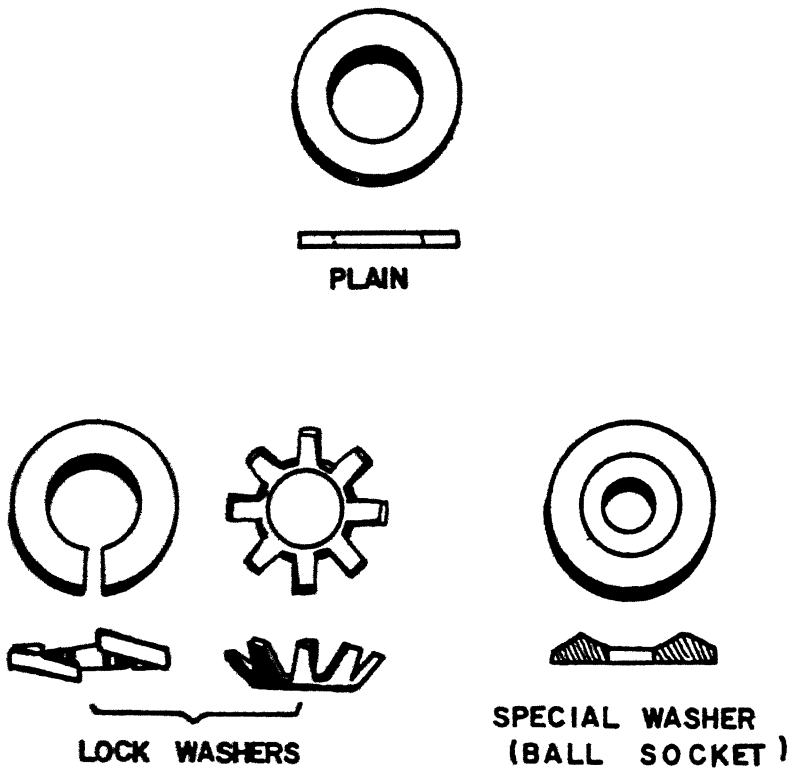


FIGURE 10-11.—Washers used in aircraft structures.

The plain washer is used under a nut to provide a smooth bearing surface, to act as a shim in obtaining the correct relationship between the threads of the bolt and the nut, and in adjusting the position of a castellated nut with respect to drilled cotter pin holes in the bolt. A plain washer is used under a lockwasher to prevent damage to the surface of a soft material.

29. (Continued)

The lockwasher is used with a plain nut when a self-locking or a castellated nut is not applicable. The spring action of the washer prevents the nut from becoming loose.

There are many types and varieties of special washers used in specific applications as directed in the maintenance instructions manual; for example, the ball socket washer is used when the bolt is installed at an angle to the surface or where perfect alinement with the surface is required at all times.

a. When a plain nut is used, a _____ washer is used.

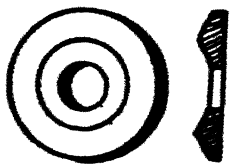
b. When a smooth bearing surface is required, a _____ washer is used.

a. lock
b. plain

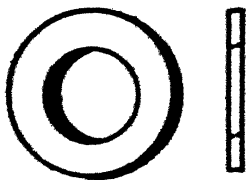
30. Match each of the washers illustrated in column *A* with its use in column *B*.

A

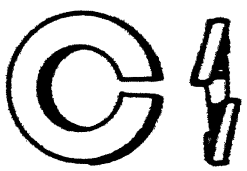
___ (1)



___ (2)



___ (3)



B

a. Used only when two dissimilar nuts are to be joined.

b. Used in specific applications when directed by the maintenance instructions manual.

c. Used with a plain nut when a self-locking or a castellated nut is not applicable.

d. Used under a nut to provide a smooth bearing surface and to act as a shim.

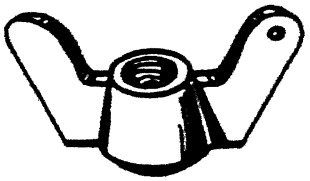
e. Used with corrosion resistant steel nuts and bolts only.

(1) b. (2) d. (3) c.

31. Match each nut illustrated in column *A* with its function in column *B*.

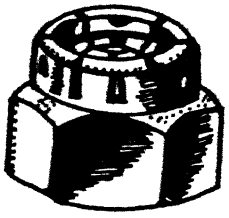
A

____ (1)



____ (2)

____ (3)



____ (4)

B

a. Used where desired tightness can be obtained by the fingers and where the assembly is frequently removed.

b. Used with a drilled shank bolt to accommodate a cotter pin or safety wire for safetying.

c. Designed to hold tight in spite of vibrations.

d. Used with an auxiliary locking device such as a lockwasher.

e. Used with castellated bolt shank.

(1) a. (2) b. (3) c. (4) d.

32. Match each of the bolt-dimension terms listed in column *A* with the section it describes, as designated on the illustration in column *B*.

A

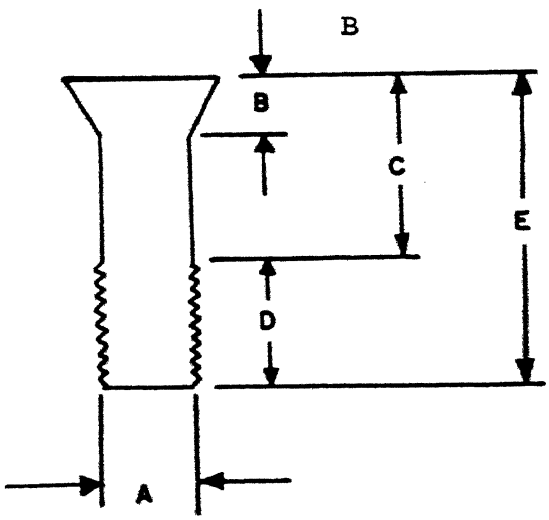
____ (1) Grip.

____ (2) Threads.

____ (3) Length.

____ (4) Diameter.

B



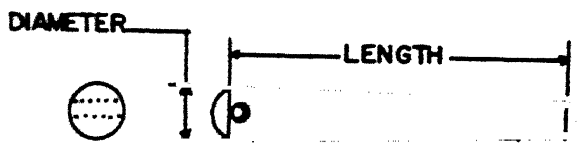
(1) C.

(2) D.

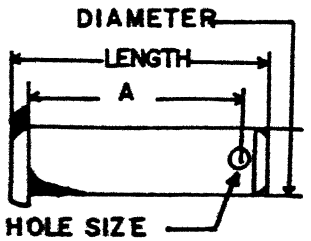
(3) E.

(4) A.

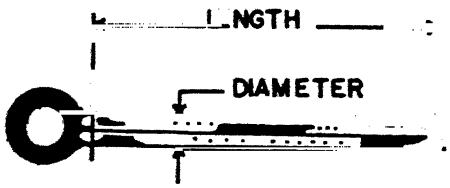
33. Pins used in aircraft structures are taper pins, flathead pins, cotter pins, and quick-release pins (figure 10-12).



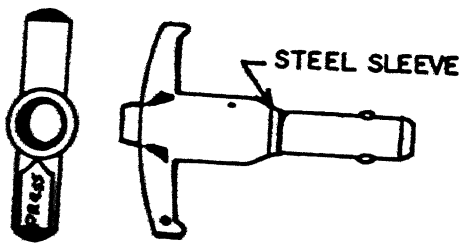
TAPER PIN



FLATHEAD PIN



COTTER PIN



QUICK-RELEASE PIN

FIGURE 10-12.--Pins.

Pins used in aircraft structures are _____ _____, _____, and _____ _____

taper

flathead

cotter

quick release

34. The taper pin has no head and is used in joints that carry shear loads and where a tight fit is essential (figure 10-13).

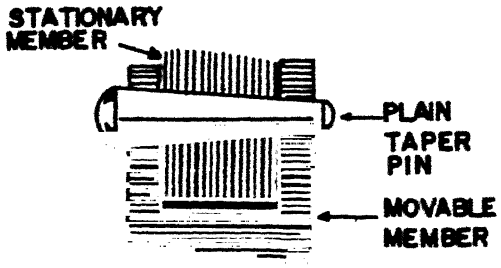


FIGURE 10-13.--The taper pin installed.

The flathead pin is used with a tie rod terminal or a secondary control that is not in operation continuously. The flathead pin should be secured with a washer and a cotter pin. The pin should be installed with the head up, when possible, so that if the cotter pin that secures the flathead pin fails or works out, the pin will remain in place (figure 10-14).

34. (Continued)

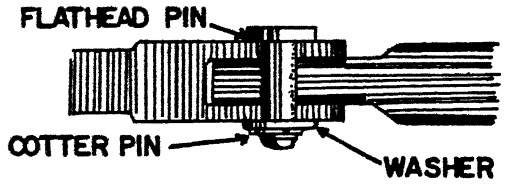


FIGURE 10-14.—The flathead pin installed.

The cotter pin is used to secure castellated nuts, pins, and shafts (figure 10-15).

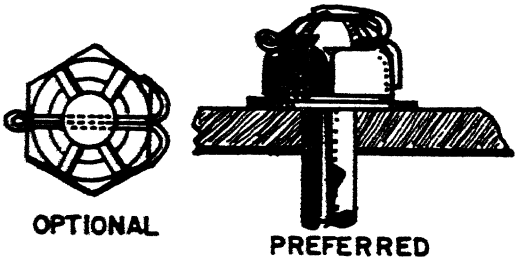


FIGURE 10-15.—The cotter pin installed.

34. (Continued)

The quick-release pin is used in some applications where rapid removal and replacement of equipment are necessary (figure 10-16).

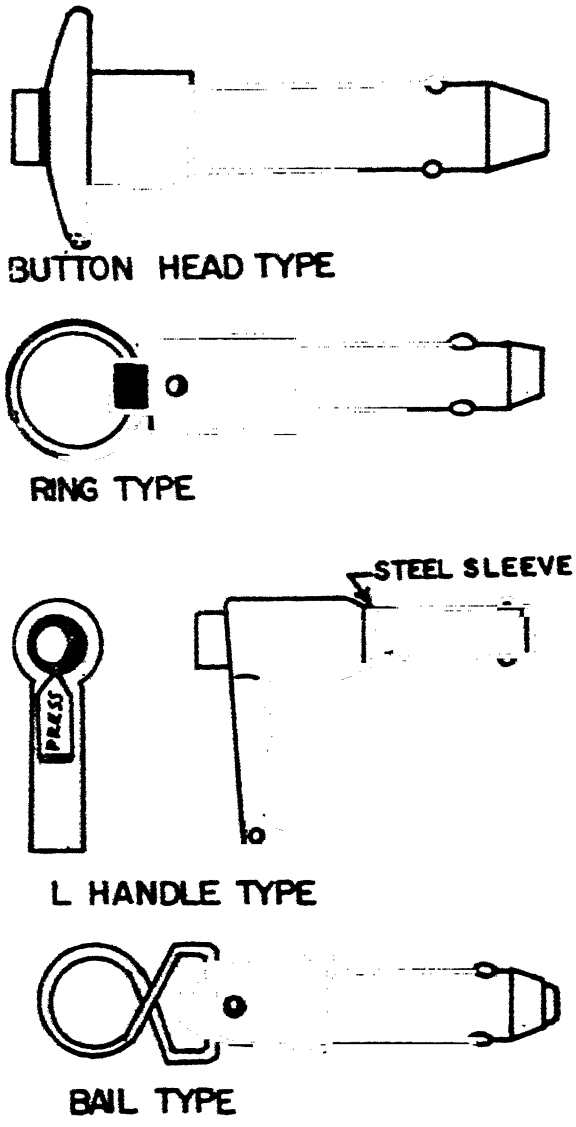


FIGURE 10-16.--The quick-release pin.

34. (Continued)

a. The pin used when a tight fit is essential is the _____ pin.

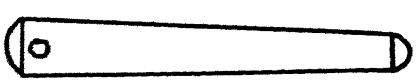
b. For a tie rod terminal, the _____ pin is used.

a. taper b. flathead

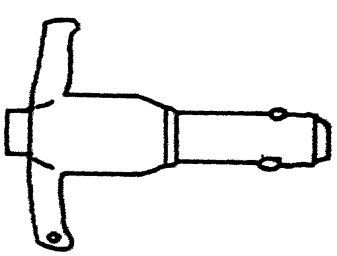
35. Match each pin illustrated in column *A* with its use in column *B*.

A

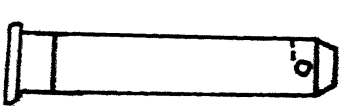
____ (1) Taper pin



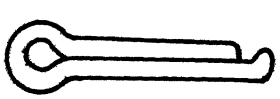
____ (2) Quick-release pin.



____ (3) Flathead pin.



____ (4) Cotter pin.



B

a. Used to secure castellated nuts, pins, and shafts.

b. Used where rapid removal and replacement of equipment are necessary.

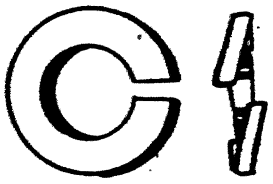
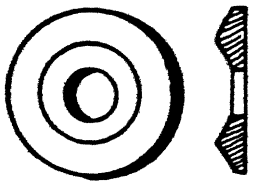
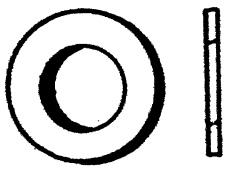
c. Used where a tight fit is essential.

d. Used with a tie rod terminal.

e. Used to attach canopy material to parachute harness.

(1) c. (2) b. (3) d. (4) a.

36. Match each of the washers illustrated in column *A* with its use in column *B*.

A		B
____ (1)		a. Used only when two dissimilar nuts are to be joined.
____ (2)		b. Used with corrosion resistant steel nuts and bolts only.
____ (3)		c. Used with a plain nut when a self-locking or a castellated nut is not applicable.
		d. Used in specific applications when directed by the maintenance instructions manual.
		e. Used under a nut to provide a smooth bearing surface and to act as a shim.

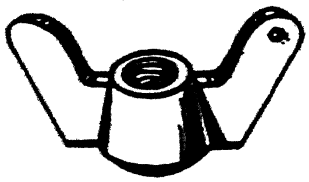
(1) c. (2) d. (3) e.

37. Match each nut illustrated in column *A* with its function in column *B*.

A

B

____ (1)



____ (2)

____ (3)

____ (4)

a. Used with a drilled shank bolt to accommodate a cotter pin or safety wire for safetying.

b. Used with an auxiliary locking device such as a lockwasher.

c. Designed to hold tight in spite of vibrations.

d. Used where desired tightness can be obtained by the fingers and where the assembly is frequently removed.

e. Used with castellated bolt shank.

(1) d. (2) c. (3) b. (4) a.

38. Threaded inserts are commonly used in the design of aircraft, engines, and accessories to protect and strengthen tapped threads in light materials (for example, aluminum, brass, and plastics), particularly in locations requiring frequent assembly and disassembly. The one-piece threaded inserts shown in figure 10-17 are inserts that are precision-formed coils of diamond-shaped wire used as screw-threaded bushings. Special insert tools are required for installation.

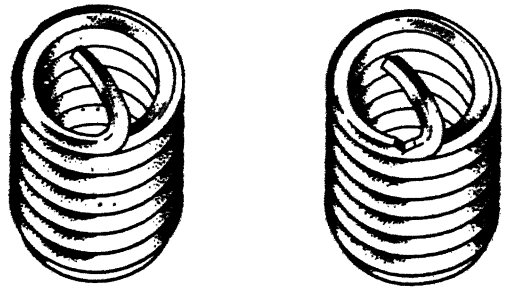


FIGURE 10-17.--One-piece threaded inserts.

To strengthen the tapped threads in light materials, metals, and plastics, a _____ _____ is used.

threaded insert

39. Select, from the list below, the use(s) of threaded inserts in the design of aircraft, engines, and accessories.

a. Used to strengthen the tapped threads in aluminum.

b. Used to place a nut in close places.

c. Used to strengthen the tapped threads in plastic.

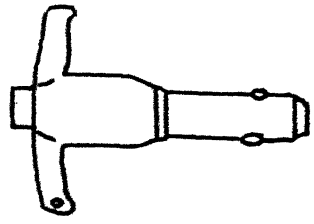
a.

c.

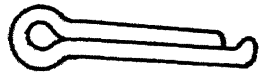
40. Match each pin illustrated in column *A* with its use in column *B*.

A

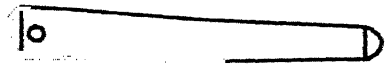
____ (1) Quick-release pin.



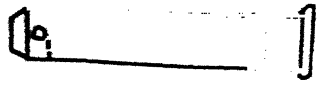
____ (2) Cotter pin.



____ (3) Taper pin.



____ (4) Flathead pin.



B

a. Used with a tie rod terminal.

b. Used to secure castellated nuts, pins, and shafts.

c. Used where rapid removal and replacement of equipment are necessary.

d. Used where a tight fit is essential.

e. Used to attach canopy material to parachute harness.

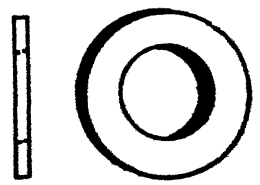
(1) c. (2) b. (3) d. (4) a.

41. Match each of the washers illustrated in column *A* with its use in column *B*.

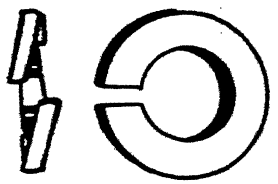
A

B

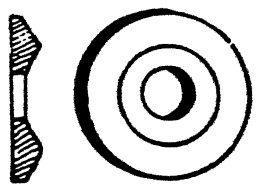
____ (1)



____ (2)



____ (3)



a. Used in specific applications when directed by the maintenance instructions manual.

b. Used with corrosion resistant steel nuts and bolts only.

c. Used under a nut to provide a smooth bearing surface and to act as a shim.

d. Used only when two dissimilar nuts are to be joined.

e. Used with a plain nut when a self-locking or a castellated nut is not applicable.

(1) c. (2) e. (3) a.

42.

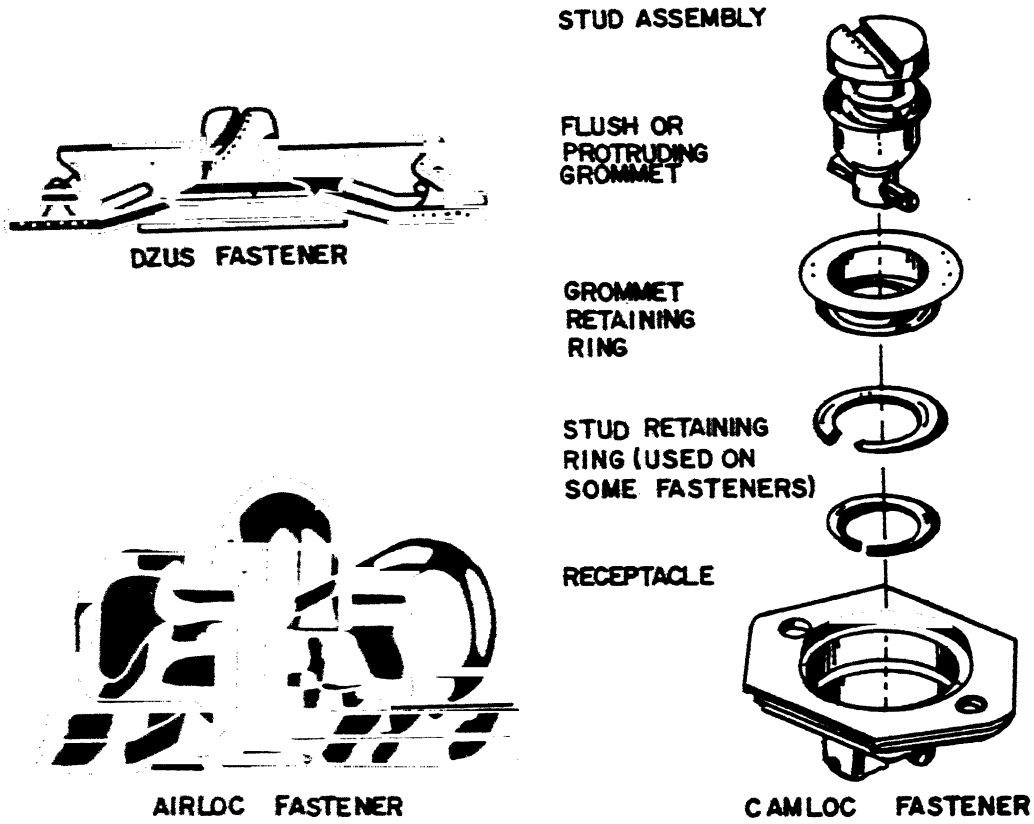


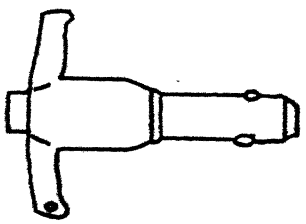
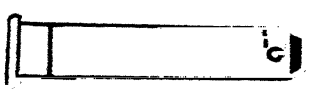
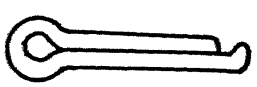
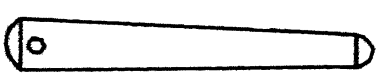
FIGURE 10-18.—Turnlock fasteners.

Turnlock fasteners are used to secure cowling, fairing, panels, and doors that require quick or frequent removal and replacement. They are secured or released generally with only a one-quarter turn of the stud. There are three basic styles of turnlock fasteners available for aircraft use (figure 10-18).

	42. (Continued) For securing cowling and panels that require frequent removal and replacement, the _____ fastener is used.
turnlock	43. Select, from the list below, the use(s) of turnlock fasteners. a. Used to secure cowling and panels that require quick or frequent removal and replacement. b. Used to replace safety pins. c. Used on panels that require a key for entry. d. All the above.
a.	44. Select, from the list below, the use(s) of threaded inserts in the design of aircraft, engines, and accessories. a. Used to place a nut in close places. b. Used to strengthen tapped threads in aluminum. c. Used to strengthen tapped threads in plastic. d. All the above.

b.
c.

45. Match each pin illustrated in column *A* with its use in column *B*.

A	B
____ (1) Quick-release pin 	a. Used where rapid removal and replacement of equipment are necessary.
____ (2) Flathead pin 	b. Used where a tight fit is essential.
____ (3) Cotter pin 	c. Used with a tie rod terminal.
____ (4) Taper pin 	d. Used to secure castellated nuts, pins, and shafts.
	e. Used to attach canopy material to parachute harness.

(1) a.

(2) c.

(3) d.

(4) b.

46. Bonding wire is used to connect all equipment so that static electricity is eliminated. An aircraft can become highly charged with static electricity while in flight. This constitutes a fire hazard and also causes radio and navigation equipment interference.

The wire used to connect equipment together is a _____ wire.

bonding	47. Select, from the list below, the reason(s) for using bonding wire on aircraft. a. To prevent static interference in navigation equipment. b. To eliminate static electricity. c. To help prevent radio interference. d. All the above.
d.	48. Select, from the list below, the use(s) of turnlock fasteners. a. Used to replace safety pins. b. Used to secure cowling and panels that require quick or frequent removal and replacement. c. Used on panels that require a key for entry. d. All the above.
b.	49. Select, from the list below, the use(s) of threaded inserts in the design of aircraft, engines, and accessories. a. Used to strengthen tapped threads in aluminum. b. Used to strengthen tapped threads in plastic. c. Used to place a nut in close places. d. All the above.

a. b.	50. Aircraft structural hardware is the greatest contributor to foreign object damage (FOD). The man-hours and dollars invested in repairing the damage that a small, overlooked, or forgotten piece of FOD can cause is enormous. Little pieces of FOD can ruin a jet engine, jam flight controls, and cause the loss of an aircraft and its crew. The removal of loose objects from pockets before working on an aircraft is a positive step toward preventing FOD. The cleaning of work areas upon completion of a job and a complete inventory of toolboxes are musts in preventing FOD. One method of preventing foreign object damage is to _____ your toolbox when your job is completed.
inventory	51. Select, from the list below, the precaution(s) to use to prevent foreign object damage. a. Remove loose objects from pockets before working on an aircraft; inventory tools when the job is completed. b. Foreign object damage cannot be prevented. c. Upon completion of a job, clean the work area of loose aircraft structural hardware.

a. c.	52. Select, from the list below, the reason(s) for using bonding wire on aircraft. a. To eliminate static electricity. b. To prevent static interference in navigation equipment. c. To help prevent radio interference. d. All the above.
d.	53. Select, from the list below, the use(s) of turnlock fasteners. a. Used to secure cowling and panels which require quick or frequent removal and replacement. b. Used on panels that require a key for entry. c. Used to replace safety pins. d. All the above.
a.	54. Select, from the list below, the precaution(s) to use to prevent foreign object damage. a. Foreign object damage cannot be prevented. b. Upon completion of a job, clean the work area of loose aircraft structural hardware. c. Remove loose objects from pockets before working on an aircraft; inventory tools when the job is completed. d. Both *b* and *c*.

d.	55. Select, from the list below, the reason(s) for using bonding wire on aircraft. a. To prevent static interference in navigation equipment. b. To help prevent radio interference. c. To eliminate static electricity. d. All the above.
d.	56. Select, from the list below, the precautions to use to prevent foreign object damage. a. Foreign object damage cannot be prevented. b. Remove loose objects from pockets before working on an aircraft; inventory tools when the job is completed. c. Upon completion of a job, clean work area of loose aircraft structural hardware. d. Both *b* and *c*.
d.	At this point, you may take the progress check, beginning on page 77. If you answer all self-test items correctly, proceed to the next lesson topic. If any of your answers are incorrect, refer to the paragraphs or frames designated on the answer sheet for the items you missed. If you feel that you do not understand most of the lesson topic, select another medium of instruction or consult your learning center instructor. When you can correctly answer all self-test items on the progress check, proceed to the next assignment.

NARRATIVE FORM

OF

LESSON TOPIC

AIRCRAFT HARDWARE

Besides the metal surfaces, which are readily seen, many different kinds of hardware are used in assembling an aircraft--rivets, screws, bolts, nuts, washers, pins, bonding wire, turnlocks, fasteners, etc. Rivets are used extensively as fastening devices. The common solid shank rivet, shown in figure 10-1, is used in fastening together an aircraft structure when both ends of the rivet are accessible. Its head may be one of several styles. Of these, the universal head rivet is used for both interior and exterior applications, and the countersunk head rivet is used on the exterior of an aircraft where a smooth aerodynamic surface is desired.

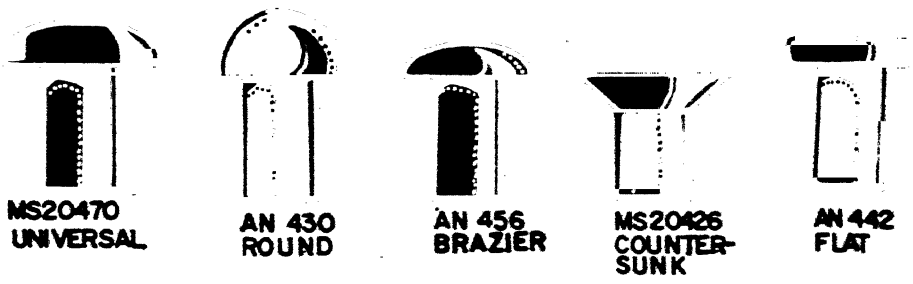


FIGURE 10-1.--Common solid shank rivets.

The blind rivet is used where only one side of the work is accessible. There are various types and head styles of blind rivets (figure 10-2), and all have the characteristic of being self-locking.

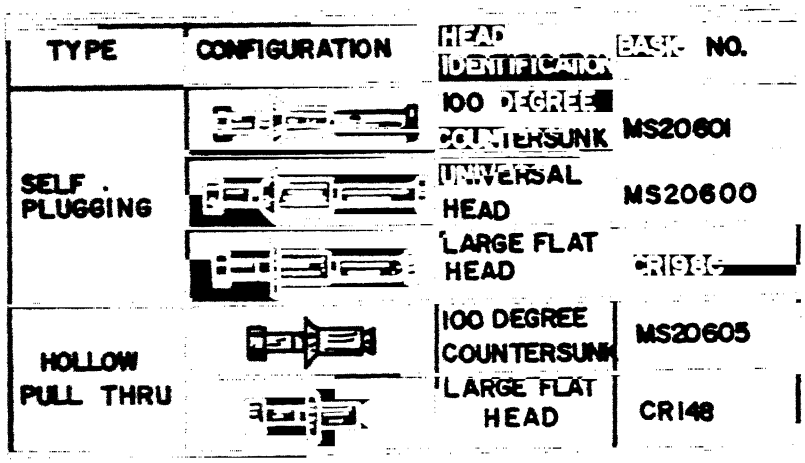


FIGURE 10-2.--Blind rivets.

When an aircraft must be repaired, rivets (as well as all other fasteners) should be replaced with an identical piece of hardware. Otherwise the structural soundness of the aircraft will deteriorate. Even resistance to corrosion will change if unlike metals are joined.

The screw is the commonest type of threaded fastener used on an aircraft. Generally, screws have a lower material strength and a looser fit than other types of threaded fasteners; however, several types of structural screws are available that differ from structural bolts only in the type of head.

Screws may be divided into four main groups--the machine screw, the structural screw, the self-tapping screw, and the setscrew. (See figure 10-3.) Each requires a particular type of screwdriver for installation. The machine screw is different from the structural screw only in the materials used and their relative strengths.

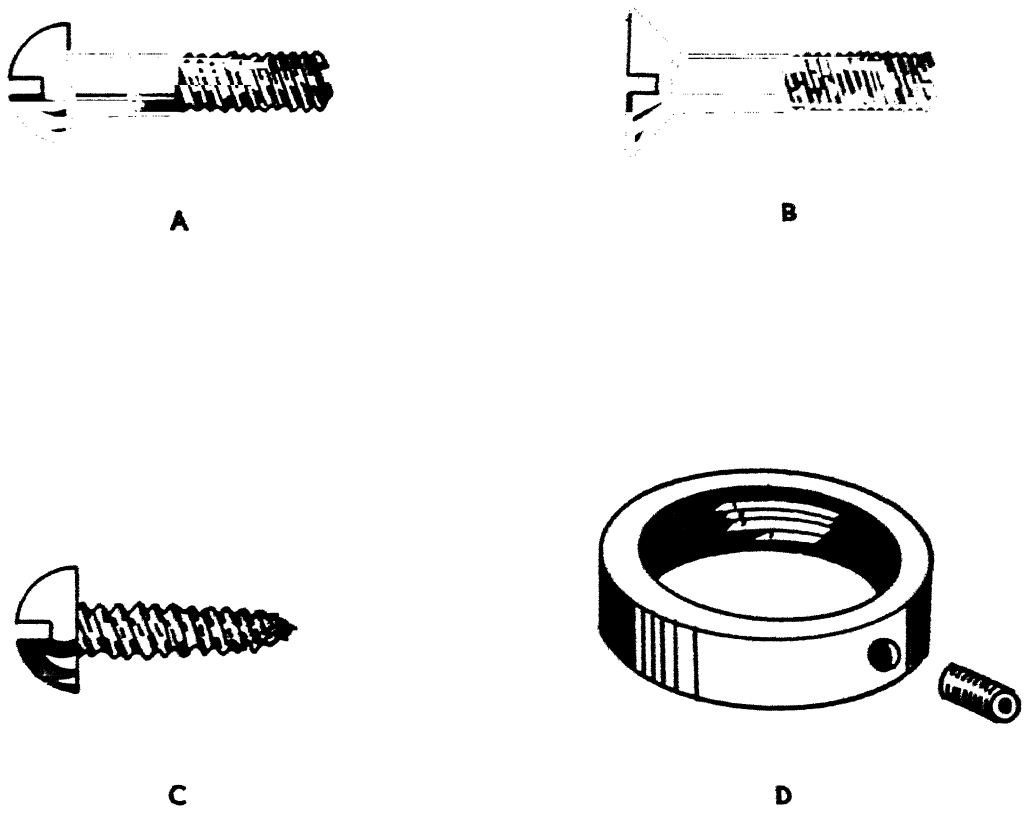


FIGURE 10-3.--Screws: (A and B) machine or structural; (C) self-tapping; and (D) setscrew.

The machine screw (A or B) is a small general purpose screw (available in low-carbon steel, brass, corrosion-resistant steel, and aluminum alloy) with various head styles. The heads of some machine screws are drilled for safety wire.

The structural screw (A or B) is used primarily for panel installation where frequent removal is required. This screw is made of alloy steel and is heat-treated to have the same tensile strength as a bolt of the equivalent size.

Note that the structural screw and the machine screw may have the same shape, the difference being in the materials and their tensile strengths.

The self-tapping screw (C) is used in nonstructural assemblies requiring a blind application. The screw is installed by drilling a hole and inserting the screw, which cuts its own thread as it is screwed into the hole.

The setscrew (D) is used to position and hold a component in place; for example, a gear or bearing on a shaft. Setscrews, which are headless, are available with many different point styles.

Machine screws and structural screws have a number of different head styles--brazier, washer, fillister, and flat (see figure 10-4).

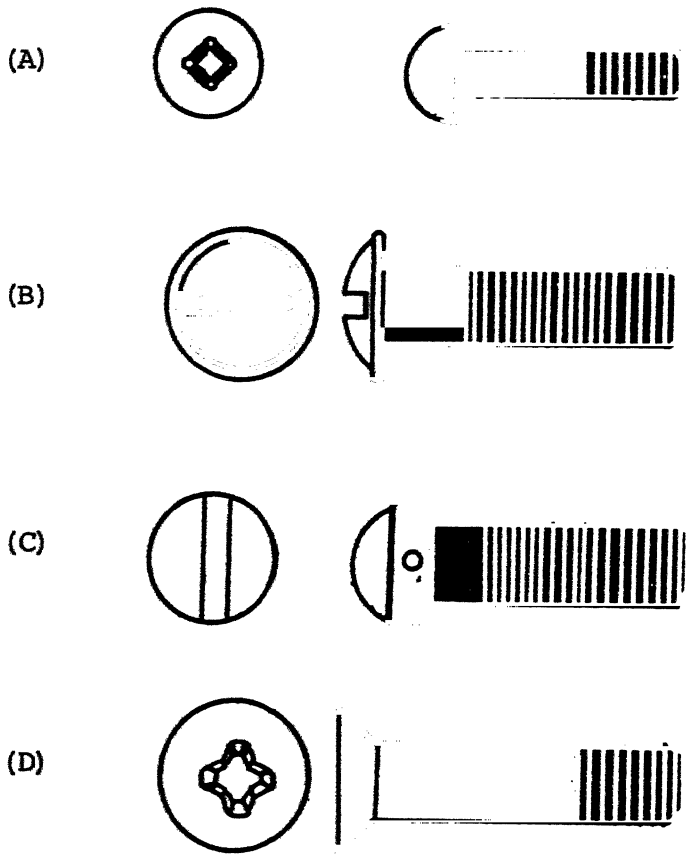


FIGURE 10-4.--Structural or machine screws: (A) brazier; (B) washer; (C) fillister; and (D) flathead.

The brazier head, the washer head, and the fillister head are normally used in the interior of the aircraft. The flathead screw is primarily used on the exterior of the aircraft and requires a hole that has been countersunk for a smooth surface.

Standard aircraft bolts are used in applications involving tension shear loads. The close-tolerance bolt is used where the bolted joint is subject to severe load reversals and vibrations. The use of a close-tolerance bolt permits the elimination of lost motion in landing gears, control systems, and helicopter rotary controls.

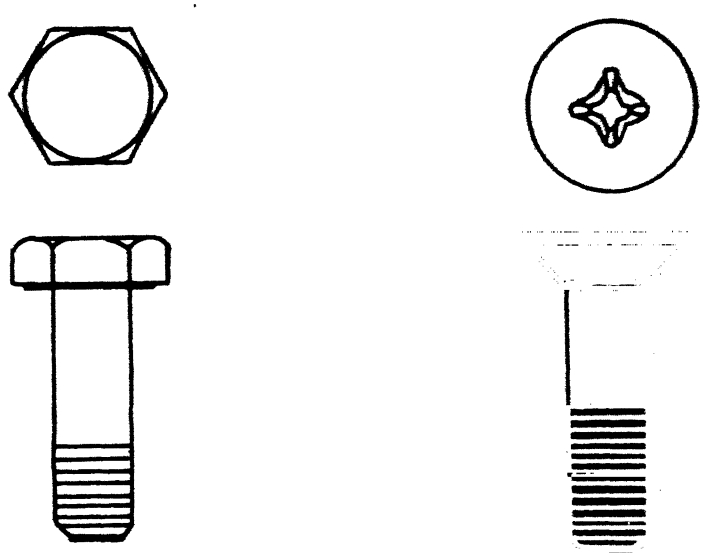


FIGURE 10-5.--Close-tolerance bolts.

Close-tolerance bolts are available with two types of heads--the standard hex head (figure 10-5A) and the 100-degree countersunk head (figure 10-5B).

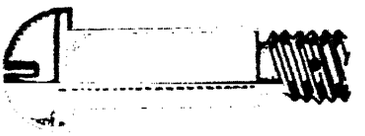


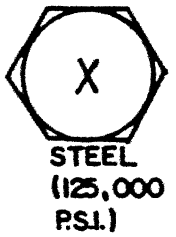
FIGURE 10-6.--The clevis bolt.

The clevis bolt (figure 10-6), which is used in applications subject to shear stress only, is often used as a mechanical pin in a control system. The head of the clevis bolt is round and slotted.

FIGURE 10-7.--The eye bolt.

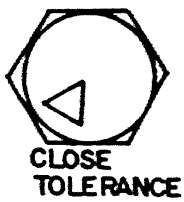
The eyebolt (figure 10-7) is used to carry external tension loads for the attachment of such devices as the fork of a turnbuckle, a clevis, or cable shackle.

The mark or marks on the head of a bolt or screw identify the material of which it is made. (See figure 10-8).



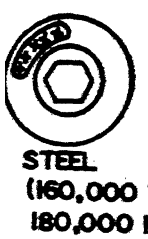
A cross denotes alloy steel with a tensile strength of 125,000 psi minimum.

Two raised dashes denote aluminum alloy.



A recessed triangle denotes close-tolerance shank and/or head (steel or aluminum alloy).

A single raised dash denotes corrosion-resistant steel.



A curved section with five crosses denotes steel with a tensile strength of 160,000 to 180,000 psi.

FIGURE 10-8.--Bolthead markings.

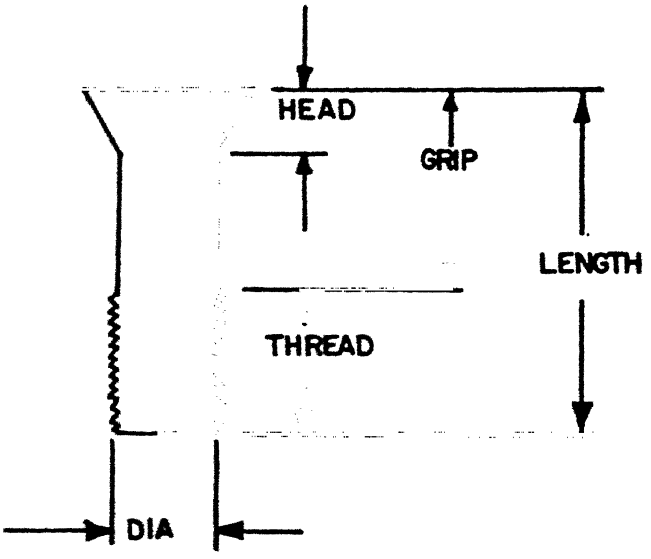


FIGURE 10-9.--Principal parts of a bolt or screw.

The most significant terms in describing a bolt or a screw are the head, the grip, threads, length, and diameter (see figure 10-9). The head is that portion of the bolt or screw with the largest diameter and may be one of many shapes or designs. A wrench is normally placed on the bolthead for the purpose of installing or removing the bolt, whereas a screwdriver is used with a screw. The grip is the distance from the underhead bearing surface to the start of the thread. The ideal installation will have a bolt or screw whose grip is a few thousandths of an inch shorter than the actual grip. All bolt or screw installations that involve self-locking or plain nuts will have at least two complete threads protruding through the nut. These two threads include the chamfered end of the bolt. However, bolts with slightly more grip length than that required may be used if washers are placed under the nut or bolthead.

The purpose of any nut is to secure the bolted assembly properly. Nuts used in aircraft structures are the plain nut, the castle nut, the wingnut, and the self-locking nut. (See figure 10-10.)

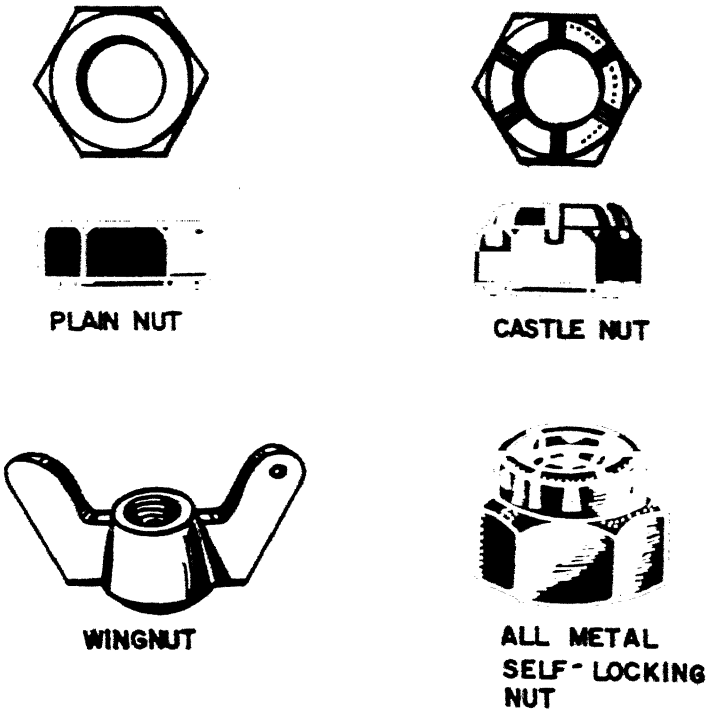


FIGURE 10-10.—Nuts used in aircraft structures.

The plain nut is used with an auxiliary locking device, such as a lockwasher. The castle nut is used with a drilled shank bolt and is secured with lockwire or a cotter pin. The wingnut is used where the desired tightness can be obtained with the fingers and where the assembly is frequently removed. The self-locking nut is designed so that it will hold tight in spite of vibrations.

The types of washers used in aircraft structures are plain washers, lockwashers, and special washers (figure 10-11).

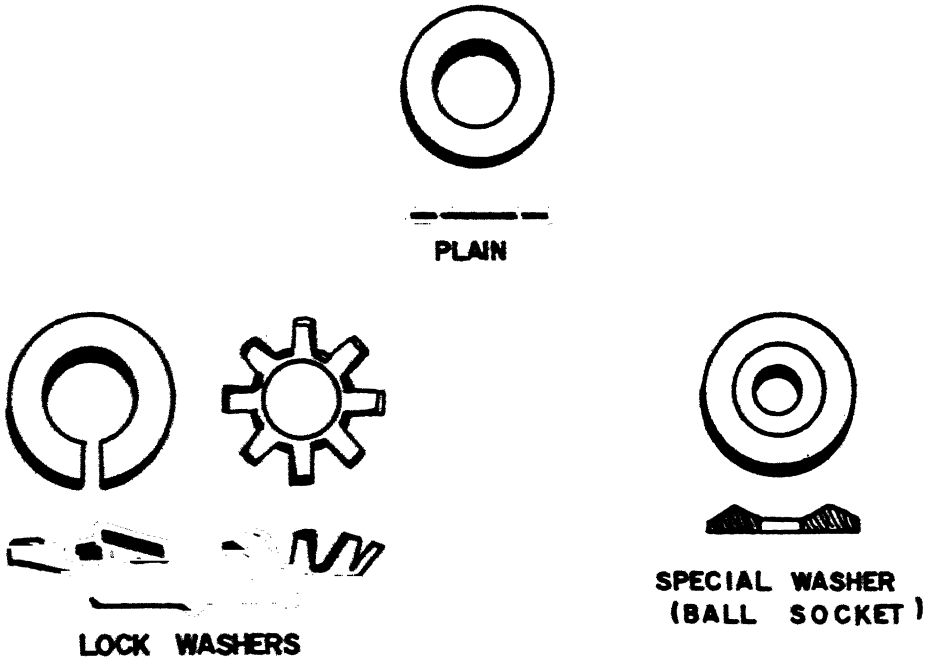


FIGURE 10-11.—Washers used in aircraft structures.

The plain washer is used under a nut to provide a smooth bearing surface, to act as a shim in obtaining the correct relationship between the threads of the bolt and the nut, and in adjusting the position of a castellated nut with respect to drilled cotter pin holes in the bolt. A plain washer is used under a lockwasher to prevent damage to the surface of a soft material.

The lockwasher is used with a plain nut when a self-locking or castellated nut is not applicable. The spring action of the washer prevents the nut from becoming loose.

There are many types and varieties of special washers used in specific applications as directed in the maintenance instructions manual; for example, the ball socket washer is used when the bolt is installed at an angle to the surface or where perfect alinement with the surface is required at all times.

Pins used in aircraft structures are taper pins, flathead pins, cotter pins, and quick-release pins (figure 10-12).

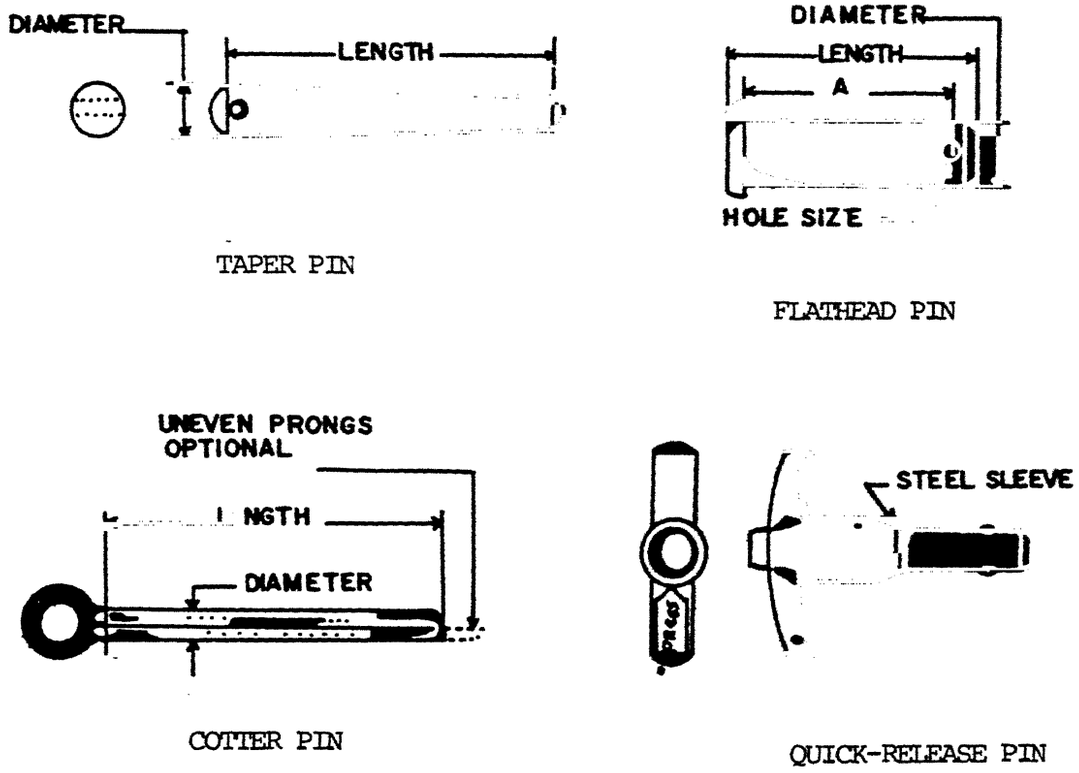


FIGURE 10-12.--Pins.

The taper pin has no head and is used in joints that carry shear loads and where a tight fit is essential (figure 10-13).

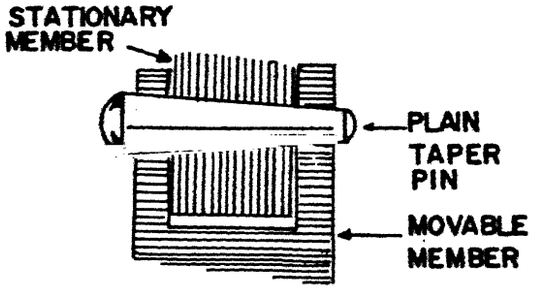


FIGURE 10-13.—The taper pin installed.

The flathead pin is used with a tie rod terminal or a secondary control that is not in operation continuously. The flathead pin should be secured with a washer and a cotter pin. The pin should be installed with the head up, when possible, so that if the cotter pin that secures the flathead pin fails or works out, the pin will remain in place (figure 10-14).

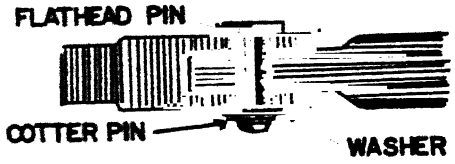


FIGURE 10-14.—The flathead pin installed.

The cotter pin is used to secure castellated nuts, pins, and shafts (figure 10-15).

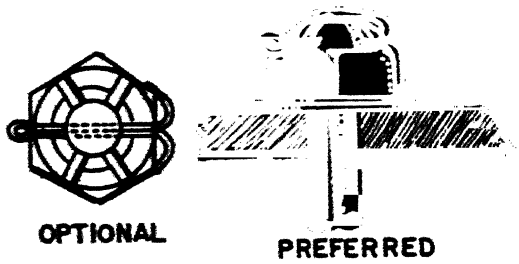


FIGURE 10-15.—The cotter pin installed.

The quick-release pin is used in some applications where rapid removal and replacement of equipment are necessary (see figure 10-16).

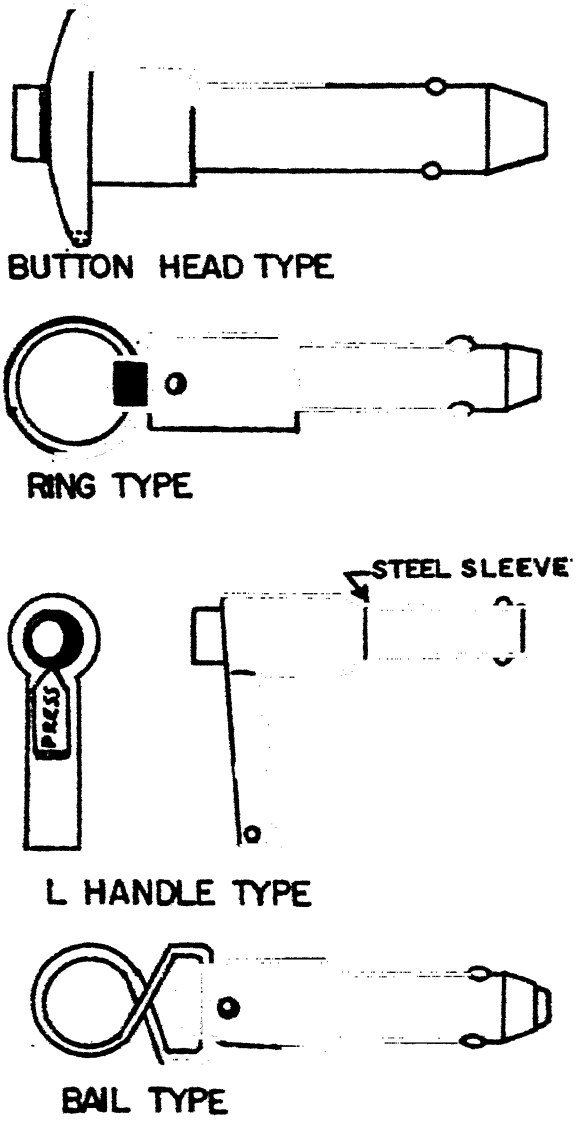


FIGURE 10-16.--The quick-release pin.

Threaded inserts are commonly used in the design of aircraft, engines, and accessories to protect and strengthen tapped threads in light materials (for example, aluminum, brass, and plastic), particularly in locations requiring frequent assembly and disassembly. The one-piece threaded inserts shown in figure 10-17 are inserts that are precision-formed coils of diamond-shaped wire used as screw-threaded bushings. Special insert tools are required for installation.

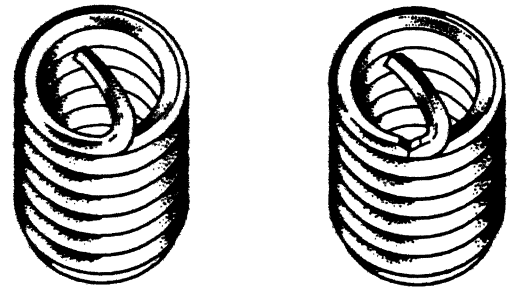


FIGURE 10-17.—One-piece threaded inserts.

Turnlock fasteners are used to secure cowling, fairing, panels, and doors that require quick or frequent removal and replacement. They are secured or released generally with only a one-quarter turn of the stud. There are three basic styles of turnlock fasteners available for aircraft use (figure 10-18).

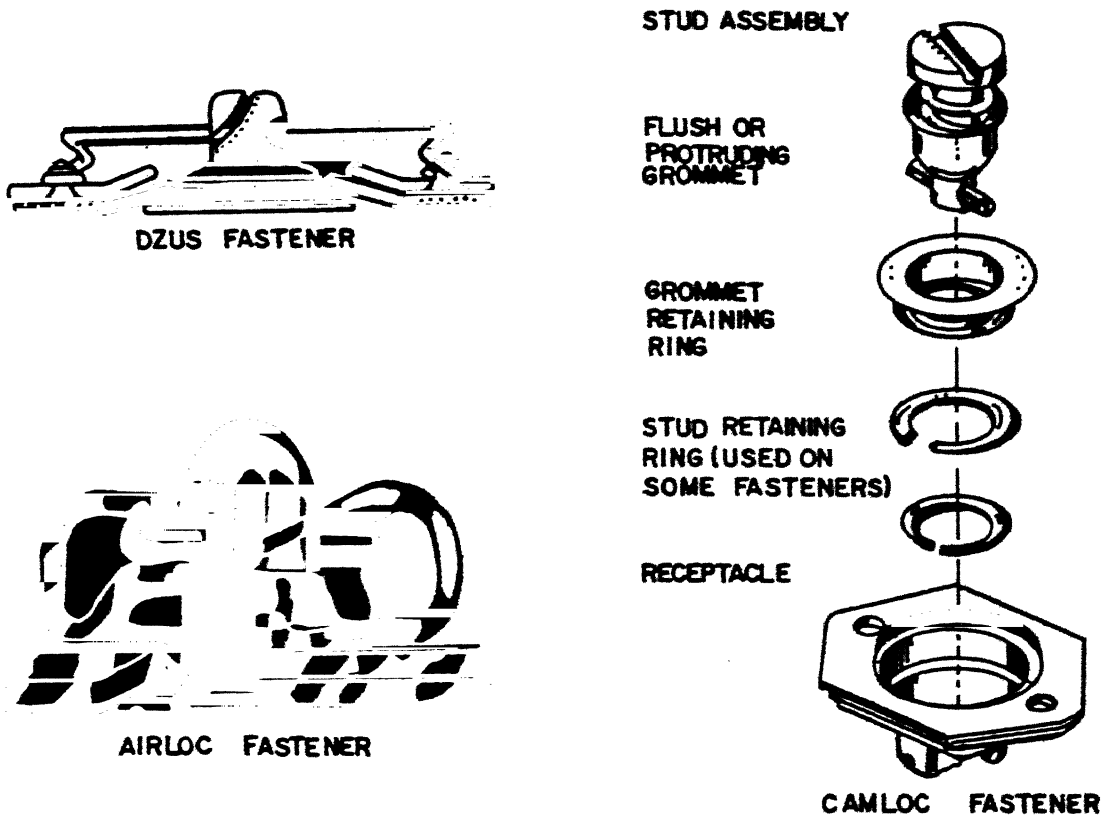


FIGURE 10-18.--Turnlock fasteners.

Bonding wire is used to connect all equipment so that static electricity is eliminated. An aircraft can become highly charged with static electricity while in flight. This constitutes a fire hazard and also causes radio and navigation equipment interference.

Aircraft structural hardware is the greatest contributor to foreign object damage (FOD). The man-hours and dollars invested in repairing the damage that a small, overlooked, or forgotten piece of FOD can cause is enormous. Little pieces of FOD can ruin a jet engine, jam flight controls, and cause the loss of an aircraft and its crew.

The removal of loose objects from pockets before working on an aircraft is a positive step toward preventing FOD. The cleaning of work areas upon completion of a job and a complete inventory of toolboxes are musts in preventing FOD.

At this point, you may take the progress check, beginning on page 77. If you answer all self-test items correctly, proceed to the next lesson topic. If any of your answers are incorrect, refer to the paragraphs or frames designated on the answer sheet for the items you missed. If you feel that you do not understand most of the lesson topic, select another medium of instruction or consult your learning center instructor. When you can correctly answer all self-test items on the progress check, proceed to the next assignment.

LESSON TOPIC PROGRESS CHECK

AIRCRAFT HARDWARE

TERMINAL OBJECTIVE:

Match four given illustrations of different types of aircraft hardware with their uses.

ENABLING OBJECTIVES:

1. Select, from a given list, the use of the common solid shank rivet.
2. Select, from a given list, the use of the blind rivet.
3. Match four given illustrations of types of screws commonly used on aircraft with their names.
4. Match four given illustrations of types of structural screwheads commonly used on aircraft with their names.
5. Match three listed types of standard aircraft bolts with their purposes.
6. Match four given illustrations of bolthead markings with statements describing their meanings.
7. Match four given bolt-dimension terms with the bolt sections they describe, as designated on a given illustration.
8. Match four given illustrations of types of nuts used in aircraft structures with their functions.
9. Match three given illustrations of types of washers used in aircraft structures with their uses.
10. Match four given illustrations of types of pins used in aircraft structures with their uses.
11. Select, from a given list, the use(s) of threaded inserts in the design of aircraft, engines, and accessories.

12. Select, from a given list, the use(s) of turnlock fasteners.

13. Select, from a given list, the reason(s) for using bonding wire on aircraft.

14. Select, from a given list, the precaution(s) to observe to prevent foreign object damage.

PROGRESS CHECK

1. Select, from the list below, the use of the common solid shank rivet.

   a. Used when only one side of the work is accessible.

   b. Used to secure panels on the aircraft exterior only.

   c. Used for fastening aircraft structures when both ends of the rivet are accessible.

   d. Used to secure panels on the aircraft interior only.

2. Select, from the list below, the use of the blind rivet.

   a. To be used when only one side of the work is accessible.

   b. To be used to secure panels when both sides of the work are accessible.

   c. To be used only when a smooth aerodynamic design is required.

   d. To be used as a temporary repair only.

3. Match each of the screws illustrated in column *A* with its name in column *B*.

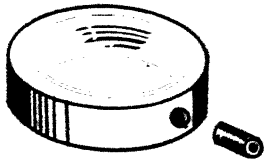
A

B

____ (1)

____ (2)

____ (3)



____ (4)

a. Setscrew.

b. Structural or machine screw.

c. Self-set screw.

d. Self-tapping screw.

4. Match each of the four types of structural (machine) screwheads illustrated in column *A* with its name in column *B*.

A

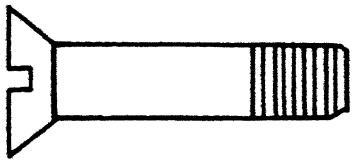
B

____ (1)

____ (2)

____ (3)

____ (4)



a. Brazier head.

b. Washer head.

c. Flathead.

d. Fillister head.

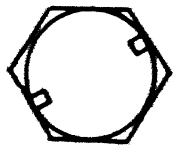
e. Filbert head.

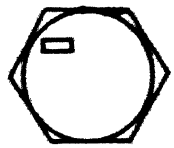
5. Match each of the standard aircraft bolts, listed in column *A*, with its purpose, listed in column *B*.

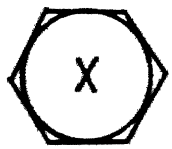
A	B
____ (1) Close-tolerance.	a. Used as a mechanical pin in a control system.
____ (2) Clevis bolt.	b. Used where a bolted joint is subject to severe load reversals and vibrations.
____ (3) Eyebolt.	c. Used whenever the self-locking nut is used.
	d. Used in the attachment of such devices as the fork of a turnbuckle, a clevis, or cable shackle.

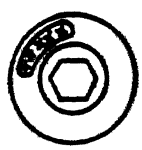
6. Match each bolthead marking illustrated in column *A* with the statement describing its meaning in column *B*.

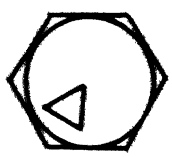
A

____ (1) 

____ (2) 

____ (3) 

____ (4) 

____ (5) 

B

a. Close tolerance (steel or aluminum alloy).

b. Corrosion resistant steel.

c. Steel (125,000 psi).

d. Aluminum alloy.

e. Steel (160,000 to 180,000 psi).

7. Match each of the bolt-dimension terms listed in column *A* with the section it describes, as designated on the illustration in column *B*.

A

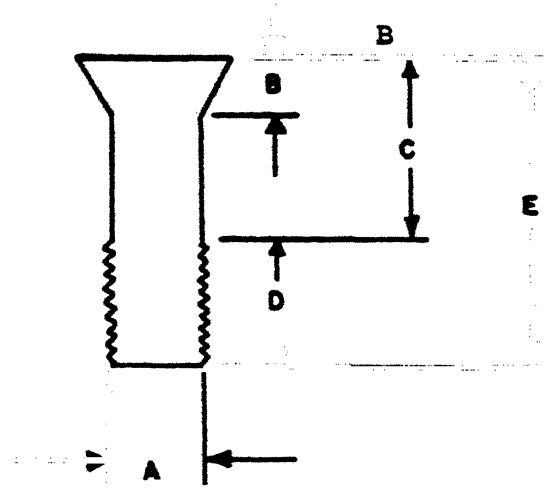
____ (1) Length.

____ (2) Diameter.

____ (3) Threads.

____ (4) Grip.

B



8. Match each nut illustrated in column *A* with its function in column *B*.

A

____ (1)

____ (2)

____ (3)

____ (4)

B

a. Used where desired tightness can be obtained by the fingers and where the assembly is frequently removed.

b. Designed to hold tight in spite of vibrations.

c. Used with an auxiliary locking device such as a lockwasher.

d. Used with drilled shank bolts to accommodate a cotter pin or safety wire for safetying.

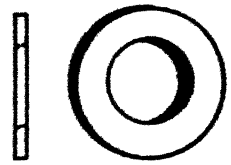
e. Used with castellated shank bolt.

9. Match each of the washers illustrated in column *A* with its use in column *B*.

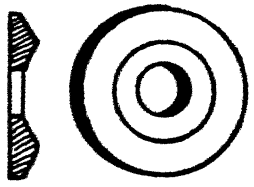
A

B

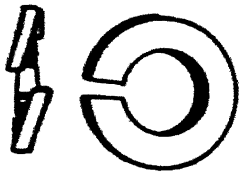
____ (1)



____ (2)



____ (3)



a. Used with a plain nut when a self-locking or castellated nut is not applicable.

b. Used only when two dissimilar nuts are to be joined.

c. Used under a nut to provide a smooth bearing surface and to act as a shim.

d. Used with corrosion resistant steel nuts and bolts only.

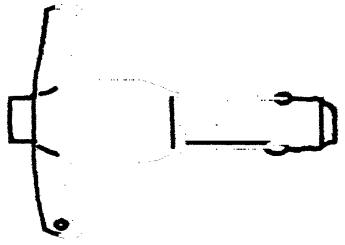
e. Used in specific applications when directed by the maintenance instructions manual.

10. Match each pin illustrated in column *A* with its use in column *B*.

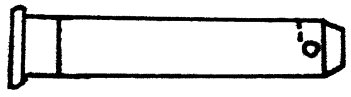
A

____ (1) Taper pin

____ (2) Quick-release pin



____ (3) Flathead pin



____ (4) Cotter pin

B

a. Used where rapid removal and replacement of equipment are necessary.

b. Used where a tight fit is essential.

c. Used with a tie rod terminal.

d. Used to secure castellated nuts, pins, and shafts.

e. Used to attach canopy material to parachute harness.

11. Select, from the list below, the use(s) of threaded inserts in the design of aircraft, engines, and accessories.

a. Used to place a nut in close places.

b. Used to strengthen tapped threads in aluminum.

c. Used to strengthen tapped threads in plastic.

d. All the above.

12. Select, from the list below, the use(s) of turnlock fasteners.

    a. Used on panels that require a key for entry.

    b. Used to replace safety pins.

    c. Used to secure cowling and panels that require quick or frequent removal and replacement.

    d. All the above.

13. Select, from the list below, the reason(s) for using bonding wire on aircraft.

    a. To help prevent radio interference.

    b. To eliminate static electricity.

    c. To prevent static interference of navigation equipment.

    d. All the above.

14. Select, from the list below, the precaution(s) to use to prevent foreign object damage.

    a. Upon completion of a job, clean work area of loose aircraft structural hardware.

    b. Remove loose objects from pockets before working on an aircraft; inventory tools when the job is completed.

    c. Foreign object damage cannot be prevented.

    d. Both *a* and *b*.

Turn to page 85 and check your answers. If you have answered all the items correctly, proceed to the progress test. If not, use another medium of instruction or consult the learning center instructor. When you can answer all the items on the progress check correctly, proceed to the progress test.

ANSWERS TO PROGRESS CHECK
AIRCRAFT HARDWARE

QUESTION NO.	CORRECT ANSWER	REFERENCE PAGES	
		Narrative Ref. Pages	PI Ref. Frames
1.	c.	61	1
2.	a.	61	1
3.	(1) d. (2) b. (3) a. (4) b.	62-64	4
4.	(1) a. (2) b. (3) d. (4) c.	64	8
5.	(1) b. (2) a. (3) d.	65-66	13
6.	(1) d. (2) b. (3) c. (4) e. (5) a.	67	17

QUESTION NO.	CORRECT ANSWER	REFERENCE PAGES	
		Narrative Ref. Pages	PI Ref. Frames
7.	(1) E. (2) A. (3) D. (4) C.	68	21
8.	(1) b. (2) a. (3) c. (4) d.	69	25
9.	(1) c. (2) e. (3) a.	70	29
10.	(1) b. (2) a. (3) c. (4) d.	71-74	33-34
11.	b. c.	74	38
12.	c.	74	42
13.	d.	75	46
14.	d.	76	50

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